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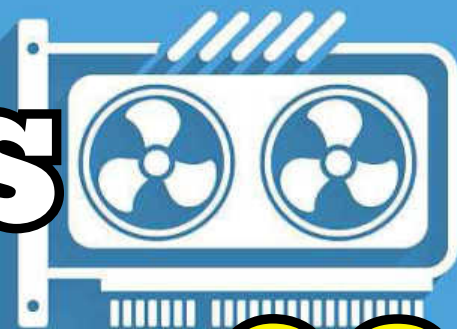
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08 Nvidia Vs AMD

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58 Back To Fax

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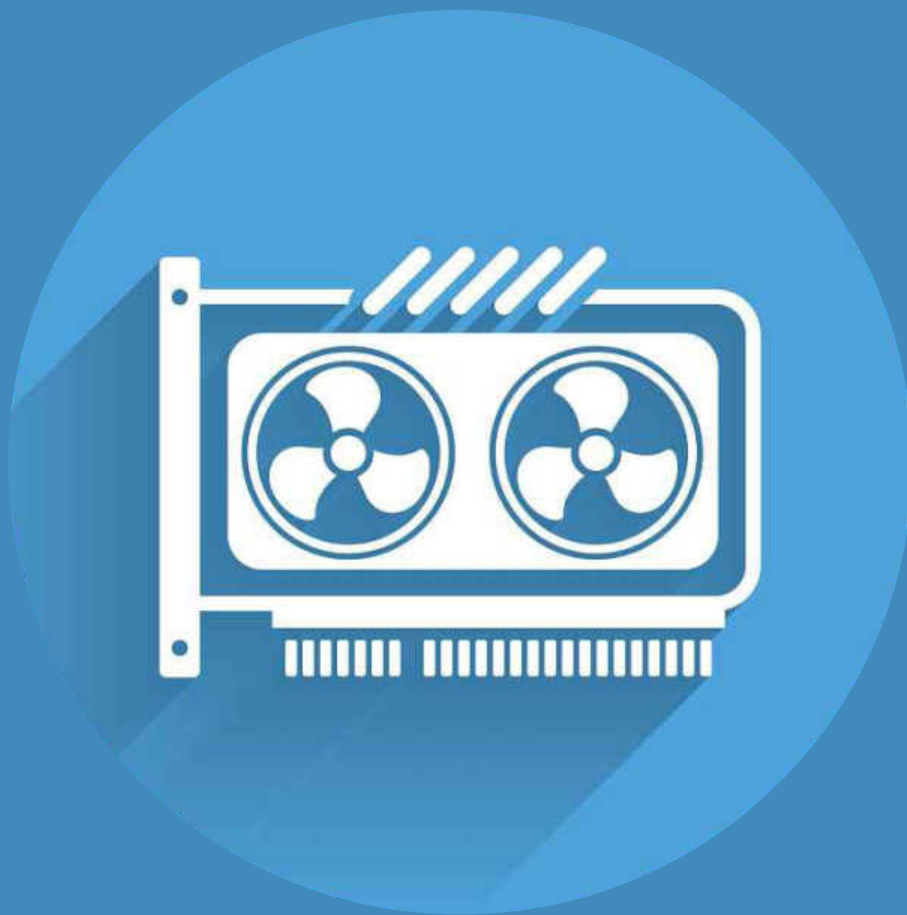
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Clash of Titans

**Mark Pickavance looks at Nvidia's new GPU dynasty
and compares them with what AMD has on offer**

For me, some of the best bits of the last 30 years of computing have involved the development of dedicated video hardware.

From the lightbulb moment that Voodoo Graphics delivered to the advent of multi-GPU systems, they've often surprised and occasionally amazed.

That said, the capability range in performance available now is so huge that no game developer could hope to encompass all the subtle layers in a single title.

Very often, they simply address the majority of their audience with a product that looks good with a £100 video card and proportionally more amazing with something better.

It's into that context that Nvidia has launched its new 10 series cards, with specifications to humble the hard-core gamer and with a price to make them weep.

Are these the GPUs we're looking for?

In The Green Corner

Nvidia has had a strong year, because in spite of some minor failings, gamers really loved the GTX 970 and bought large numbers of them.

According to the latest figures, 5% of all Steam gamers use one of these cards, even if they do cost from about £240, and the vast majority are usually in the £250-270 bracket. It has a bigger brother, the GTX 980, and that costs north of £400, and its Ti variant is over £500, and above that is the awesome GTX Titan X.

That very top rung will cost you an eye-watering £900 to £1,200, for a card with 12GB of GDDR5 RAM.

All these cards were based on a microarchitecture called Maxwell, were fabricated on a 28nm process, delivered between 3.5 and 6.2 gigaflops of processing power and could consume 250W of power doing that.

For those who wanted something affordable, Nvidia offered the GTX 950 and 960, although compared with their bigger brothers, they offered modest numbers of shader cores and memory bandwidth.

Now comes the new 10 Series, using a new Pascal GPU design built around the same model as Maxwell, but now using TSMC's 16nm FinFET fabrication for even greater possibilities.

The small tracks allow for even more cores, higher clock speeds and better heat management.

Fig. 1 shows the complete specs of the GeForce GTX 1080 and GTX 1070, compared with the GTX 380Ti and Titan X designs that preceded them.



▲ To give it a full title, this is the GeForce GTX 1080 DirectCU III OC Strix Gaming Aura RGB 8192MB GDDR5X PCI Express graphics card. But fork over £659.99 and you can call it whatever you like!

Looking at these details, a few things stood out that can stand greater explanation, because in many ways, these new cards are an odd hybrid between the ones they replace and something entirely different.

Nvidia GPU Line-up					
Model		GTX 1080	GTX 1070	GTX Titan X	GTX 980Ti
Microarchitecture		Pascal		Maxwell	
GPU Code name		GP104-400	GP104-200	GM200-400	GM200-310
Fab (nm)		16		28	
Transistors (billion)		7.2		8	
Die Size (mm2)		314		601	
Bus Interface		PCIe 3.0 x16			
Shader Processors, Texture Mapping Units, ROPS		2560:160:64	1920:120:64	3072:192:96	2816:176:96
Clock Speeds	Base Core Clock (MHz)	1607	1506	1000	1000
	Boost Core Clock (MHz)	1733	1683	1075	1075
	Memory (MT/s)	10000	8000	7010	7010
Fillrate	Pixel (GP/s)	102.8	96.4	96	96
	Texture (GT/s)	257.1	180.7	192	176
Memory	Size (GiB)	8		12	6
	Bandwidth (GB/s)	320	256	336	336
	Bus Type	GDDR5X	GDDR5		
	Bus Width (Bit)	256		384	
API Support (Version)	Direct3D	12			
	OpenGL	4.5			
	OpenCL	1.2			
	Vulkan	1.0			
Processing Power (Gflops)	Single Precision (Boost)	8228 (8873)	5783 (6463)	6144	5632
	Double Precision (Boost)	257 (277)	181 (202)	192	176
	Half Precision (Boost)	16457 (17746)	11566 (12925)	N/A	
TDP (Watts)		180	150	150	

▲ Fig. 1



▲ The Nvidia reference Founders Edition cards have a single fan, but it looks like most manufacturers will give it more cooling

With a memory pathway that's just 256 lanes wide, compared with 384 bits wide on the Maxwell cards, that's a much easier design and therefore a less expensive board to build.

To achieve similar levels of bandwidth, the memory clocks have been increased from about 1752.5MHz on the GTX 980 to 2000MHz on the GTX 1070 and a whopping 2500MHz on the GTX 1080.

In addition, the GTX 1080 also employs GDDR5X, a modified version of GDDR5 that doubles the prefetch, theoretically doubling the memory speed while being almost identical in other respects.

“ The first point to make is that neither of these products is an impulse purchase unless you're very well off indeed ”

That said, technically, these cards actually have less bandwidth than the Titan X and GTX 980 Ti (336GB/s), though both have more than the GTX 980.

What Nvidia appears to have done is to make this design marginally faster than the Titan X, delivering the performance crown. However, Nvidia also put a decent slice of that pie into reducing the power consumption by a whopping 28% compared to the Titan X and GTX 980 Ti.

With less power consumption comes less heat or, if you wish, more heat and greater overclocking, if you want that. Or you can run stock and cool.

Therefore, these cards should overclock easily or be able to game for many hours without overheating. At least that's the theory.

With the first retail products hitting the shelves, I decided to acquire a couple and put them through their paces, because while technology might be one thing on a spec sheet, there's no better acid test than actually giving them something difficult to render at a high resolution and frame-rate.

Retail Products

I'd like to thank Asus for providing two cards from its range for me to experience. At this time, it makes two baseline cards (called Founders Editions) and two Republic of Gamers Strix models, and it provided one of each level (see Fig. 2).

Model		Asus ROG Strix GeForce GTX 1070	Asus ROG Strix GeForce GTX 1080
Street Price		£479.99	£659.99
Shader Processors/Texture Mapping Units/ ROPS		1920:120:64	2560:160:64
Clock Speeds	Base Core Clock (MHz)	1632 (1506)	1785 (1607)
	Boost Core Clock (MHz)	1835 (1683)	1936 (1733)
	Memory (MT/s)	8000	10000
Fillrate	Pixel (GP/s)	106.1 (96.4)	114.2 (102.8)
	Texture (GT/s)	265.3 (180.7)	285.6 (257.1)
Memory	Size (GiB)	8	
	Bandwidth (GB/s)	256.3 (256)	320.3 (320)
	Bus Type	GDDR5	GDDR5X
	Bus Width (bit)	256	
TDP (Watts)		150	180

▲ Fig. 2

The first point to make is that neither of these products is an impulse purchase unless you're very well off indeed. However, these are at the high end of the price scale, and some makers are offering the GTX 1070 for as little as £365.

What you don't get at that price is the exotic triple fan cooler that Asus designed Aura, the LED lighting or the not insignificant clock tweaks.

I've put the baseline clocks in brackets for you to realise how much they've been adjusted, and these changes do make these Asus Strix designs some of the fastest 10 Series you're likely to encounter.

Power consumption of these cards is much less than we've become accustomed to for flagship designs, with the GTX 1070 having only a single eight-pin PCIe power connector and a maximum TPD of just 150W. The GTX 1080 needs both an eight- and six-pin power, but it only uses another 30W, even if that configuration gives it 250W to play with.



▲ The cooling system in the Asus Strix models is very sophisticated and allows you to overclock without flirting with a GPU meltdown

AMD's Best Single GPU Video Cards				
		AMD Radeon R9 Nano	AMD Radeon R9 Fury X	AMD Radeon R9 390X
GPU Codename		Fiji	Fiji	Hawaii
Fab		TSMC 28nm	TSMC 28nm	TSMC 28nm
Transistors (billion)		8.9	8.9	6200
Die Size (mm ²)		596	596	438
Bus Interface		PCIe 3.0 x16		
Shader Processors, Texture Mapping Units, ROPS		4096:256:64	4096:256:64	2816:176:64
Base Clock		1000MHz	1050MHz	1050MHz
Fill Rate	Pixel (GP/s)	64	64	67.2
	Texture (GT/s)	256	256	184.8
Memory	Clock	1Gbps HBM	1Gbps HBM	6Gbps GDDR5
	Bus Width	4096-bit	4096-bit	512-bit
	Size	4GB	4GB	8GB
	Bandwidth (GB/s)	512	512	384
	Bus Type	HBM	HBM	GDDR5
API support (version)	Direct3D	12		
	OpenGL	4.5		
	OpenCL	2.0		
Processing Power (Gflops)	Single Precision	8192	8601.6	5913.6
	Double Precision	512	537.6	739.2
TDP (Watts)		175W	275W	275W
Architecture		GCN 1.2	GCN 1.2	GCN 1.1

▲ Fig. 3

Accordingly, the recommended PSU for the GTX 1070 is just 500W, and the GTX 1080 will work with a 550W PSU, making for a modest configuration unless you intend to use SLI and more than one card.

At this price, you get what you pay for, and Asus put these beauties together with a high degree of precision and finesse. I wonder how they run?

In The Red Corner

For whatever reason, I haven't seen an AMD Fury card before now, a technology that first appeared in June 2015.

AMD's special sauce was boiled down into four video cards that use the Fiji-cored GPU, the R9 Fury, R9 Fury X, R9 Nano and the dual GPU Radeon Pro Duo.

By way of context, I was loaned by XFX an R9 Nano that in almost every respect has an identical profile to the Fury X, AMD's best single GPU card.

A typical price for this card would be just over £400, making it a good bit cheaper than either the GTX 1080 or 1070.

It's also much smaller, being able to fit into any ATX case, and it has a TDP of just 175W. Fig. 3 shows the critical specs compared with the Fury X and AMD's previous performance king the R9 390X.

What's interesting about the Fury designs in particular are their use of HBM memory and not GDDR5, empowering them with huge amounts of bandwidth and a massive memory bus width.

I wouldn't read too much into the number of shaders compared with those on the Nvidia cards, because the way they're organised is entirely different, and they're not 'oranges-to-oranges' comparable.

Probably the most important aspect of AMD's hardware is the relatively low clock speed of the GPUs, mostly due to them being hamstrung by the TSMC 28nm fabrication.

For my testing, XFX kindly loaned me one of its Nano models. This isn't the very quickest AMD card, not being a Fury X, but it is representative of what it has to offer until a new flagship design comes along.

However, based on AMD's recent announcements, the Fiji-based cards aren't likely to be directly replaced by their new Polaris GPU designs – at least not initially.

Benchmarks

I'm sure other people will be able to test just about any title you can game on this hardware, but I just wanted to get a flavour of what sort of performance the Pascal GPU has on offer.

For this, I used my trusty test rig. Built on an Asus Sabertooth X79, it has a Core i7-3960X CPU, 16GB DDR3 quad-channel memory, Crucial MX100 SSD and Windows 10 Build 14361.



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While there are bigger computing beasts available (the new Xeons, for example), there is still plenty of power in this platform to push a video card or even multiple ones.

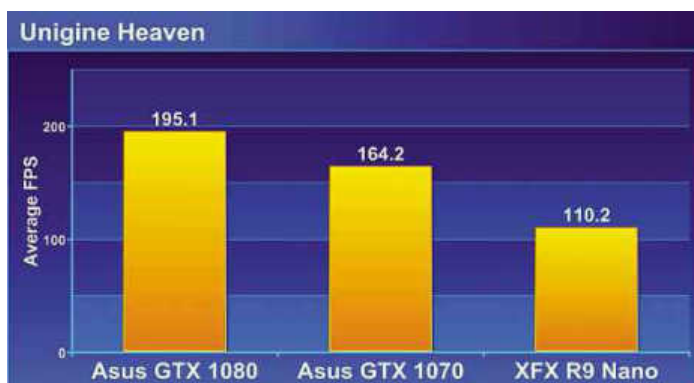
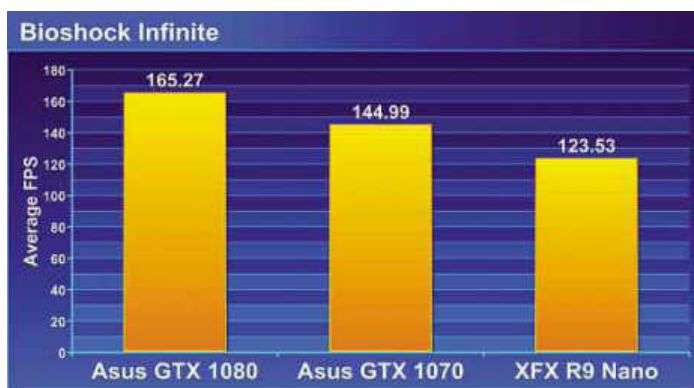
The selection of tests I used isn't massive, but it gives us a flavour of what the Pascal designs can do when compared with what AMD currently offers. However, it's worth considering from the outset that these are pre-overclocked Pascal cards and therefore a decent chunk quicker than stock items.

On the flipside of that thinking, this hardware is so new, it isn't fully optimised on the driver side of the process, so these same tests performed six months down the line might yield different results.

Bioshock Infinite

I bought this title recently when it could be purchased for 99p, and that was still probably too much. However, it does have an integrated benchmark, and because it uses lots of atmospheric effects and water, it's worth firing up.

To make this more challenging, I moved all the quality settings to ultra and ran it in 1080p. Given the results on the GTX 1080 and GTX 1070, it would probably be perfectly playable at 4K resolutions in these settings.



The stepping in this graph suggests that the GTX 1070 is about 15% slower than the GTX 1080 and the Nano is about the same ratio below the GTX 1070. That probably suggests that AMD's Fury X would straddle the Nano and 1070, making both Asus's cards quicker than any single GPU that AMD had in its previous generation.

That the Nano is only 75% of the power of a GTX 1080 probably flatters the AMD chip, as we'll see in later benchmarks.

Unigine Heaven And Valley

I like these tests because I can tell by the GPU temperatures that they really make the video card work. Both were run at 1080p on DX11, and on Valley I upped the ante by using x8 anti-aliasing, and on Heaven I used Normal tessellation.

If I'd had more time, perhaps I would have run in 1440p or maybe in stereo 3D, but as you can see from the average frame-rates, these are already tough tests.

Of these two benchmarks, Heaven is easier or a least it is for the Pascal cards, because they're achieving between 49% and 77% higher frame-rates depending on the card model. Those margins are less on Valley, at just 26% and 42%, but the message is the same: a significant victory for Nvidia.

My interpretation of these results is that the 8GB of memory that the Pascal cards come with is ideal for computational graphics with high complexity, because it gives lots of very high speed working room for tessellation and geometry manipulation. While in theory the Nano has more bandwidth, having 4GB of HBM might not be enough in these scenarios.

3DMark Fire Strike

This is probably the best-known benchmark, and while its synthetic, it's worth running if only so anyone wanting to know how their system compares can make a quick and easy comparison.

With such power on hand, I ran the standard 'Performance' test, the Extreme version and the new Ultra mode, all in 1080p. I could have run them in 1440p or even 4K, but the scores show that even the Pascal cards are riding uphill in Ultra settings.

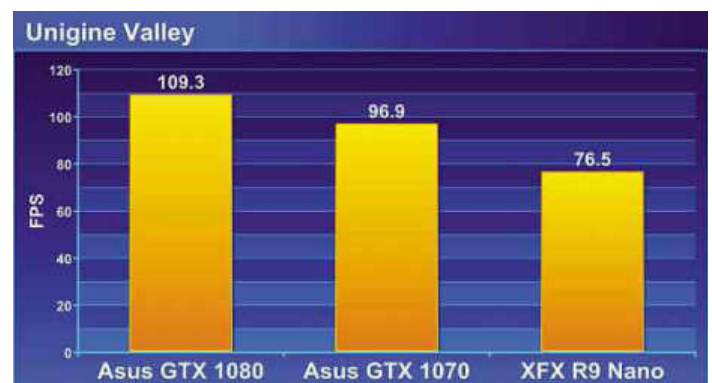
As an extra bonus in these tests, I had some data I'd recently collected on the XFX R9 390X to throw into the mix.

It doesn't really matter how you slice and dice this test; the new GTX 1080 is at least 50% quicker than the Nano, and in the Ultra mode is double the performance of the R9 390X. Those are scary numbers, and when I did overclock the GTX 1090 to 2,011MHz, I managed a score of over 10,000 in the Extreme mode.

However, there is some light at the end of AMD's tunnel in the next test.

3DMark API Overhead

Technically, this isn't a true benchmark, and Futuremark is clear to outline that in its notes. Yet it does provide some insight into how





well some video hardware will perform in respect of DX12 and its superior handling of API draw calls.

I've stuck to the DX12 part of this test, because the Pascal cards can't do AMD's Mantle API.

Again, the Asus Pascal cards win, or rather the GTX 1080 does, and the GTX 1070 gets pipped at this post by the XFX R9 390X, curiously. Why would this be?

If you go back and look at this card, while it doesn't have some of the things the Nano gets, it does have a couple of cards up its

“ Are multi-GPU systems, the likes of which we've seen before, gone from Nvidia's pathway forever? ”

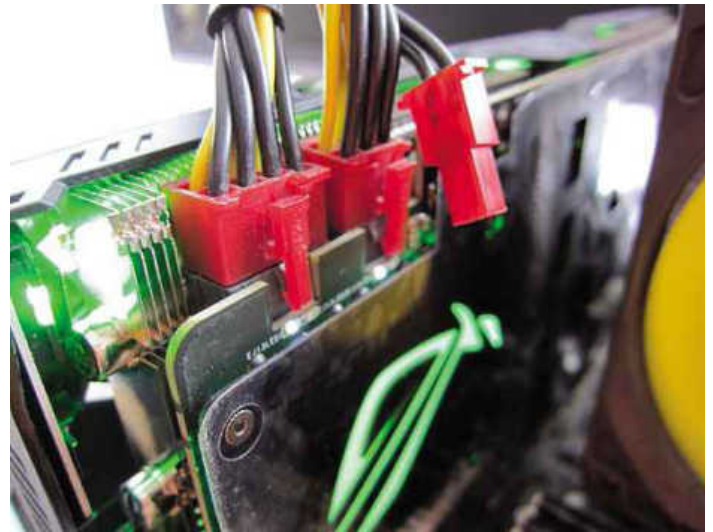
sleeves. One of these is 8GB of RAM, and the other is excellent double-precision performance.

I'm not sure which of these comes into play here, but however it works, the AMD cards can be very good in call handling under DX12 – something the Pascal cards achieve mostly through brute force, it seems.

What isn't shown here is that under Mantle, the Nano achieved 20 million draw calls and the 390X a whopping 21.3 million. So in terms of API efficiency, Nvidia still has some work to do.

World of Tanks 9.15.0.1

Benchmarking this game isn't easy, but I managed to create a method myself using FRAPS and a game replay I made. In the sequence, I tear around a town level in my Cromwell Berlin, making mincemeat out of three enemy tanks before suffering an unfortunate engine fire. The recording lasts 200 seconds, so there are plenty of frames to render and average.



▲ For flagship designs, the GTX 1080 and GTX 1070 are very frugal with power compared with the cards they replace. The GTX 1080 show here uses an eight- and a six-pin PCIe power line and the GTX 1070 a single eight-pin line

I set the game to the very highest quality settings possible and ran it in both 1080p and 1440p.

I'm glad I ran the 1440p tests on this game, because frankly the 1080p ones are all within a margin of error and are probably capped by this title's rather poor use of my multi-core processor.

I suspect, although I didn't test it, that I'd be getting around 116fps on average even at 4K resolutions on the Asus GTX 1080, though the GTX 1070 is affected by the move up in detail.

At 1080p, the Nano does well enough, but at 1440p it suffers and registers about 70% of the GTX 1070 and 60% of the GTX 1080 levels.

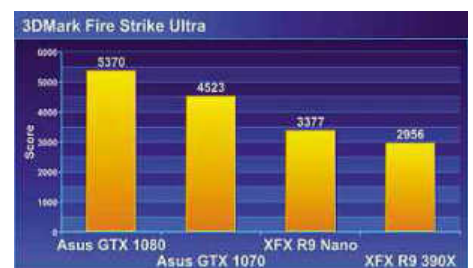
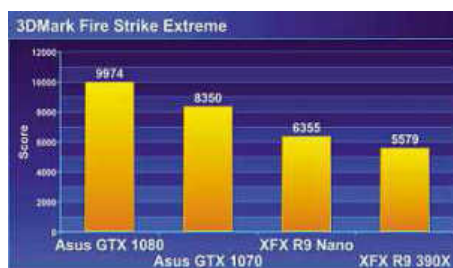
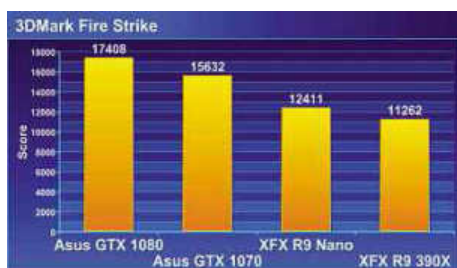
As cobbled-together as this test was to a degree, it's the one that gives the best impression of what real gaming experience is likely to be for GTX 1080 and GTX 1070 purchasers.

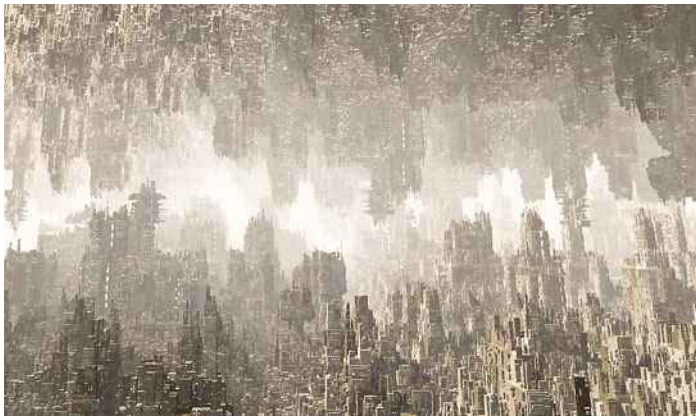
Tweaktown

I didn't really have a chance to explore what overclocking powers these cards had, but the hints are that they're immense. In fact, what exploration I did manage made me wonder why Asus had been so reserved with what enhancements it allowed itself, given the substantial headroom in this design.

All I had time to do was whack the GPU clock up from a boost of 1936 to 2011MHz on the GTX 1080, and with zero voltage added ran 3DMark FireStrike Extreme, which it executed flawlessly. That took the score to over 10,000, and the card only peaked at 74°C – hardly very warm.

However, the temperature limit is a relatively low 82°C, so for those wanting to really make these cards sing, they might want to consider water cooling it at some point.





According to Asus, it's had one card up to 2145MHz, though frankly how high any one will go without problems isn't predictable given how thin the tracks on these chips are. These pre-overclocked designs are on average 15% faster than the Founders Edition out of the box, and there might be at least another 5-10% in there for the ardent tweaker.

My only concern would be that given how much just one of these costs, destroying it through experimentation would be the last thing on my mind. Frankly, what blessings these designs bestow are probably enough for most people and the vast majority of current games.

“AMD might well take the ultimate performance crown by weight of numbers or just by being more cost effective”

Two Small Weaknesses

While I was testing these cards, I noticed a couple of aspects to them that aren't ideal, so I need to point those out.

The first is that when the new 10 Series cards were first announced, Nvidia made much of the multi-GPU capabilities, and it was reasonably concluded that the ultimate gaming system could be created by getting an X99 platform with four PCIe x16 slots and a PSU the size of a dumpster, and dividing and conquering pixels on a massive scale.

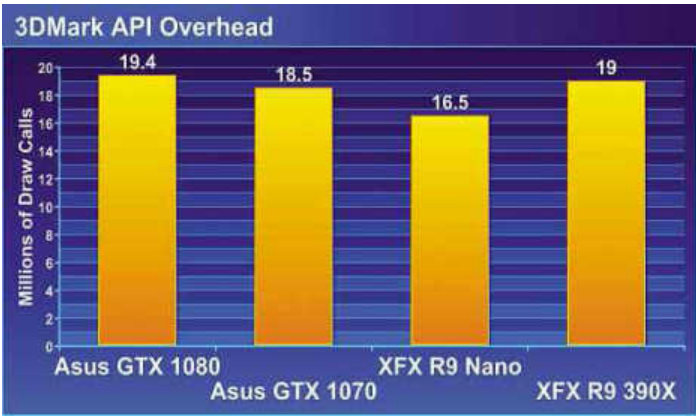
However, it turns out that with this design, a problem exists that the most of these you can combine is two, or at least you can combine more, but they won't work with the majority of titles.

What complicated this story is that initially Nvidia talked about three- and four-way configurations, using a bridge connector that is unique to these cards.

With such powerful cards, it was determined very early on that the bandwidth of the PCI bus wasn't enough to support many of these cards, so Nvidia designed a special 'high bandwidth' pathway to enable them to share data effectively.

Before launch, it said that while three- and four-way configurations weren't what it was recommending, it would release a special driver Enthusiast Key (a software code) to unlock this functionality.

And then it decided that it wouldn't do that, even if it had promised to do so, and its latest statements on the subject suggest that it's done with more than two-card SLI.



The rub here for Nvidia was between implicit and explicit SLI, where under implicit mode, it divided the workload between cards and conversely in the explicit mode, the game developer controlled the allocation.

Just not enough game developers would use explicit mode, and often due to inefficiencies, implicit mode actually reduced the performance of multiple cards or at best didn't justify the extra expense.

So are multi-GPU systems, the likes of which we've seen before, gone from Nvidia's pathway forever? Not entirely, no.

For example, it's possible to use more than two cards in a number of contexts, especially those that aren't games. And you can use two Pascal-cored cards in SLI and have a third in 100% PhysX mode.

And Microsoft has promised a special multi-GPU mode for DX12 that will enable you to mix and match any GPU (even AMD and Nvidia) for some extra horsepower.

In fairness to Nvidia, the number of people using these types of system is remarkably small, and the effort to make them work reliably huge, so I fully understand why it's chosen to put a stop to it.

The other issue is one that isn't a problem now, but could become one further down the road: DX12 performance. At this time there are virtually no DX12 games around, because the vast majority of PC owners aren't on Windows 10 to have this API.

What's critical to realise about DX12 is that when AMD presented its Mantle API, it turned many heads at Microsoft, which embraced the idea and folded it into its next version of DirectX.

AMD built its Fury architecture to work the best in Mantle, and unsurprisingly it goes great on its latest hardware, as does DX12 for much the same reason.

Nvidia's Maxwell architecture just isn't set up for working in this way, and while it can perform well, it doesn't sparkle like AMDs can.



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And Pascal is based on Maxwell, and the numbers suggest that it isn't built for DX12 in the way that AMD GPUs are. Or they're not optimised yet.

The thing is, AMD was thinking about Mantle probably four or five years ago at least and tailored its development to what it saw as the most effective API change.

While Mantle ended up with modest support, what it did was get people thinking about exploiting more GPU power and reducing the bottleneck that existed between the CPU and GPU in a modern PC.

It may be that Nvidia will be able to adapt Pascal in the next iteration or the one after that, and those changes will probably sync better with the rise of DX12 titles. But at this time it isn't ideally positioned to exploit Windows 10 and those demos and games that use its gaming API.

What About The AMD RX 480?

What isn't here, because they're not yet available for me to test is the new AMD RX 480, a card that has attracted many people's interest.

AMD has outlined that this card isn't meant to replace the Fury X or R9 390X as a flagship design, and the intention is that this will be a \$200 card for the 4GB model and \$225 for the 8GB variant.

What will be fascinating to see is if it's anywhere near the performance of the Nano, because two of these working in CrossFireX mode for £100 less than the GTX 1070 would be a clear and present danger for Nvidia.

Until those tests are run, this is all conjecture, though I think most gamers would be delighted with an affordable card that can run 1440p games and has enough power for VR applications.

Final Thoughts

If you want the fastest possible single video card, then the answer is the GTX 1080, at this time. And based on the limited experience I've had so far, the Asus pre-overclocked design looks superior. That was so simple a conclusion that I can catch that early bus!

But life is never that straightforward, is it? And the GTX 1080 and 1070 invite as many questions as they answer, the first of those being what those retailers holding stock of the Titan X cards are going to do with them.

For the majority of my readers, the really good news here isn't that they can blow another massive chunk of cash on something they'll supersede a year from now, but the downward pressure it will put on the GTX 970 and correspondingly the GTX 960 below that.

Being realistic, these £100-£150 options are the cards people actually buy most of the time, not ones that cost more than a typical computer.



With no other 10 series cards available other than the two so far announced, the 9 series will still be a major factor for some time to come and probably the major contributor to Nvidia's profitability.

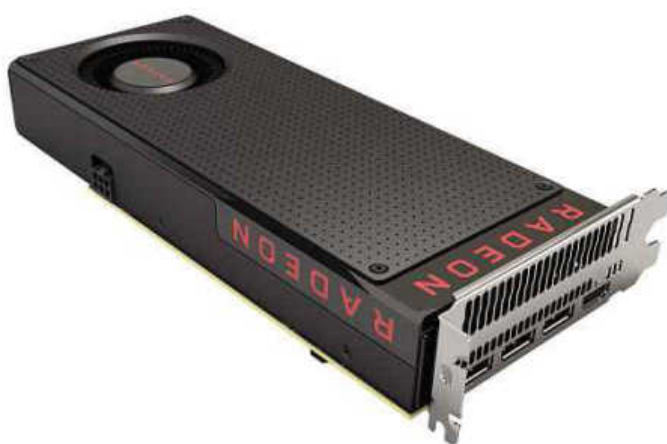
Another factor in those numbers is undoubtedly what AMD has planned, because the new RX 480 is about to arrive (as I write this) and that could be a game changer from an entirely different perspective.

Instead of coming to fight Nvidia's best toe to toe, it looks like AMD is much more interested hitting it's competitor's bottom line with a card that is affordable, yet powerful enough. And with the same multi-GPU restrictions that slightly salted Nvidia's new products, AMD might well take the ultimate performance crown by weight of numbers or just by being more cost effective.

Until I test the RX 480, it's impossible to make that call, but the prices that both sides have been getting to for video cards has been silly, and AMD looks like it's determined to bring them back to a level where more gamers can afford something that can handle all the eye candy at high resolution.

As for the GTX 1080 and GTX 1070, they're wonderful cards if your case can handle them, your system has a CPU that can exploit them and your bank account can suffer the consequences of that purchasing decision.

But if you don't have a Core i7 CPU and at least a 1440p monitor and an SSD, then they probably shouldn't be at the top of your shopping list until you have. [mm](#)





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Create A Smart Home With Home Automation

Remotely control devices, entertainment, security, heating and more with these smart devices. **Roland Waddilove** explores the home automation market

Home automation is a hot topic and a potentially massive market waiting to be exploited by developers and users. Billions of pounds are expected to be spent on automation products for our homes over the coming years, and experts are predicting that there will be tens of billions of devices by the year 2020. It's hard to completely avoid, and everyone will have at least some home automation products – if not now, then very soon.

So what is home automation? It's basically the control of commonly used devices around the home. This includes the heating of your home, the lighting, possibly ventilation, cleaning devices, security systems and much more. Many things can be either fully automated or controlled to some degree. For a fun video explanation see youtu.be/mqp8_ROAIJY.

The smart home is a related term that covers home automation and the smart devices that are available for our homes. There's also overlap with the Internet of Things (IoT), which is a popular topic of discussion these days. Home automation products don't have to be connected to the internet, but often they are, because it increases their functionality and it makes it easier to control devices. With internet access to devices, or at least wi-fi, you can monitor and program the functions of devices at home even when you're out, such as at work.

Home automation, smart home and IoT are all similar; they describe the ways we can automate the devices around us. For example, imagine removing the light switches from your home and having automatic lights. When you walk into a room and the light level is below a certain amount, such as at night, the light could automatically switch on. No more fumbling for the light switch. When you leave a room, the lights could switch off automatically too.

It's easy to detect when there's someone in a room or when it's empty. Burglar alarms do it all the time. Instead of sounding an alarm, movement is used to switch lights on and off.

Thermostats connected to your home's heating can perform a similar function. You probably have your home heating on a timer, and it comes on at a certain time of the day and switches off at a preset time. That is inefficient, because it might be on when there's no one at home. Imagine a home heating system that could tell whether someone was in the house and could turn itself on and off based on occupancy. The heating could automatically switch off when you leave for work in the morning, because it detects that the house is empty. It could automatically switch on when you return in the evening based on activity and movement in the house.

It's also possible to control other devices in a similar way. For example, if there's no one in the lounge, your television could automatically switch off. You would not want this to be set to instantly switch off, because you might simply be in the kitchen making a cup of tea during a commercial break. A timer would be involved, so if there's no one in the room for 10 minutes, the TV could switch off.

Remote Vs Automatic Control

Home automation devices are wide ranging, and the way they're controlled vary. Is a TV remote control a home automation device? In a way it is, although you might not have thought of it this way. What about a light bulb that can be turned on or off, or the brightness varied by tapping an app on your phone? Your phone just becomes a remote control for your lights.

In some cases, home automation simply means adding remote control to devices, such as lights, power plugs and heating. You can sit on your sofa and turn on the music entertainment system, turn on the TV, turn up the heating if you're feeling cold or turn it down if you're hot.

Home automation devices can be automatic too. Your movement around the house can be tracked by placing sensors in rooms, and devices can be turned on when you enter, and off when you leave. Sometimes, devices can be used in both automatic and manual mode using a remote control, phone app or a web browser on your PC. Most home automation products have web browser access, but it's easier to take your phone out of your pocket than to boot up your desktop PC.

Hubs

Many home automation systems use a hub, although it may be optional. Companies often provide a wide range of smart home automation products, including heating, lighting, power, security and more. The hub works a bit like a wireless router, where all the devices connect wirelessly to the hub and the hub is then connected to your home wi-fi network. It provides one access point for up to 50 smart devices.

There's more than one communications protocol, and a hub from one manufacturer might not support devices from another. Take care to ensure that devices are compatible if you plan to mix and match from different manufacturers. Some hubs are quite expensive, so you don't want to have to buy more than one. If a hub is necessary, it makes your first device expensive because of the added cost, but subsequent devices use the same hub.

“ Everyone will have at least some home automation products – if not now, then very soon ”

The cheapest solution is to stick to the same manufacturer for all your devices, then you know they're all compatible and all connect to the one hub. Some hubs and smart devices do support multiple standards, though, such as Apple HomeKit, Google Nest, or Z-Wave. These are preferable to devices that support a single standard. If you swap your phone, it would be a disaster if there wasn't an app on that platform – iOS or Android. If there isn't an app, there's usually web browser access from a PC.

Security Worries

Some home automation devices worry people, and there are security and privacy issues that must be considered. For example, your movement around your house may be monitored by internet connected sensors for lights, heat, hot water and so on. The devices might connect to a server on the internet so you can remotely control them using an app on your phone or computer.

This is convenient, of course, but it also means that someone is tracking you wherever you go, which raises privacy concerns. If someone hacked into that online server or device, they could tell whether the house was empty or not, or cause mischief by changing settings.

Many security experts say that home automation devices and the Internet of Things currently lack sufficient security, so hackers could easily gain access to them. Inadequate security on these devices could let someone learn your home wi-fi password, and once they're into your network, they could then access computers, phones and tablets that contain private information like contact details, banking information, passwords, usernames and more.



▲ Replace your power sockets with this and you can control it from your PC or phone



▲ Control the power to devices using the Belkin WeMo Insight Switch

Future Worries

Will home automation devices you buy today work next year or in several years time? The market is still young and developing. Companies that look like a sure bet today might not be around in a year's time. Where will that leave your home automation devices?

It has happened before, and no doubt it will happen again. An example of this is the Revolv Hub (revolv.com), which was designed to be the control centre for your smart connected home automation devices. It enabled you to access and control multiple devices that might use different protocols and networking standards to communicate. The idea was great, and you could control all your devices through one app, no matter who made them or where they are.

Nest bought Revolv and was then in turn taken over by Alphabet, which is, of course, Google's parent company. Revolve Hub development was then shut down, and a statement on the Revolv website says, "As of June 19, 2016, Revolv service will no longer be available. The Revolv app won't open, and the hub won't work." In other words, your smart home control centre has just been bricked!

There's no way of telling how long the smart devices and home automation products you buy today will work. Companies may go out of business, products may be discontinued, and new and better technologies may replace the existing ones, leading to incompatibility.

Smart Power

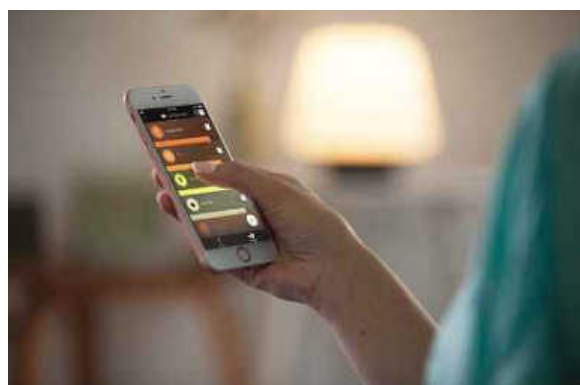
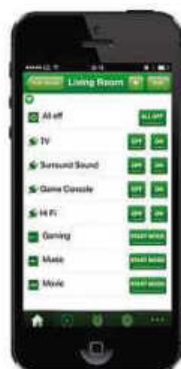
LightwaveRF LW260 13A Socket

An easy way to turn your ordinary home into a smart home with automation devices is by controlling the power. An example of this is the LightwaveRF (lightwaverf.com) 13A wall socket. This is the exact same size and shape as a normal 13A three-pin UK wall socket, and it's wired in exactly the same way. All you need to do is to unscrew and remove the old one and replace it with this smart socket. Anyone who's done DIY jobs around the home will find this straightforward, but if in doubt, get an electrician to do it.

Replacing one or all the sockets in a house with these smart versions enables them to be controlled with a smartphone app or web interface. Search for LightwaveRF in the Google Play store, and you'll find an app for your Android phone.



▲ This three-pack from Lightwave is cheap and offers remote control and smartphone programming



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▲ **Belkin's programmable automated LED lighting kit is reasonably priced**

It enables you to control every socket in your house and you can set one so it can't be turned off, which is handy for fridges and freezers. You can also set one so it can't be turned on, such as in a child's bedroom, or you can manually turn sockets on or off, for when you're too lazy to get up from your sofa to turn off the TV. (Standby is not off and wastes electricity.)

A single socket is £29.95, and a double socket is £39.95. The phone app is free, and there's an option to control everything from a web browser on your computer, which is handy if you get to work and remember you've left something switched on at home. When you add up the cost of a whole house, it's quite a significant figure, but you can start with one socket and add more whenever you have the money.

Belkin WeMo Insight Switch

If fiddling around with the mains wiring of your home frightens you, there's a safer way to control the power to devices like TVs, lamps, music systems and so on. You can use a plug-in adapter.

There are many to choose from, and you can buy them singly or in multipacks that work out cheaper if you're going to buy several. The Belkin WeMo Insight Switch is an example. There are cheap mains adapters that work with a simple remote control, but the WeMo connects to your home wi-fi network and can, therefore, be accessed with an app on a mobile phone (iOS or Android) or computer.

The WeMo Insight Switch can be controlled remotely, and you can turn multiple devices in your home on and off. The power can be scheduled, so devices can be completely turned off at night when you're asleep or during the day if you're out, but turned on in the morning or when you return from work. They can automatically respond to sunrise and sunset, and can send you custom notifications to enable you to monitor usage and cost.

The plug looks expensive on the Belkin website and is priced at £49.99, but as with many of the other products featured here, discounts are available if you shop around, and it's only £39.99 at Maplin (maplin.co.uk), for example.

LightwaveRF LW381 3-Pack

Not all power controllers are expensive, and there are cheaper ones, like the LightwaveRF LW381. This is a pack of three power plugs and a remote control that's available from discounters for around £27. They plug into the wall socket, and you then plug

your equipment into them. They handle up to 3000W, and you can sit in bed or on your sofa and use the remote control to turn devices on or off.

They're part of a family of products from LightwaveRF, which can all be controlled and programmed using a smartphone app. You could create a program for watching movies that turns on your TV and associated boxes, dims the lights and so on. You can also turn devices on or off from work or anywhere in the world.

Smart Lighting

Philips Hue lighting

Philips Hue (meethue.com) is a range of smart light bulbs that enable you to automate and control the lighting in your home without getting out of bed or off your sofa. No more getting up to walk to the light switch to turn it on or off; you can simply tap a remote or phone app. A nice feature of these light bulbs is that they gradually grow lighter when you wake up on dark winter mornings. It's supposed to mimic the rising sun, so you gradually awaken rather than having a bright harsh light in your eyes.

You can buy individual components, but it's best to begin with something like the Philips Hue white ambience starter kit A19, because it contains everything you need. Additional components, like extra light bulbs, can be added later.

The starter kit includes two light bulbs, a dimmer switch and a bridge. The bridge supports up to 50 devices and is a sort of wireless router or control centre for your smart gadgets. The dimmer switch enables you to control up to 10 light bulbs, and it can be screwed or glued to any wall.



▲ **Replace your radiator valves with this remote controlled one from LightwaveRF**



▲ Salus has a range of smart controls to manage the heating in your home

Phillips Hue supports the iPhone and iPad and is compatible with Apple HomeKit, which is Apple's home automation system. It also supports Google Nest and Android. Smartphone apps enable you to turn lights on and off, check the status of lights from anywhere in the world using the phone app, program lighting moods for various occasions like movie night, and so on. There's also support for If This Then That (IFTTT), an app that enables actions to be performed when certain conditions are met or events occur.

“ Many security experts say that home automation devices and the Internet of Things currently lack sufficient security ”

Philips doesn't sell direct, so shop around. Amazon, for example, has Philips Hue light bulbs from £14.95, while a smart dimmer switch is £19.95, and starter kits cost from £29.99. The A19 starter kit with the bridge is £149.99.

Belkin WeMo LED Lighting Starter Kit

Belkin (belkin.com/uk) also has a lighting starter kit, which consists of two smart LED light bulbs and WeMo Link. The small WeMo Link gadget is the hub that connects to all WeMo smart devices in your home and to your wireless router. It enables the light bulbs and other smart devices to be controlled using an app on your iPhone, Android phone or PC.

The WeMo LED lights can be turned on or off remotely, and since it's controlled by a phone app, you can be sitting in the same room or anywhere in the world. If you're on holiday, you can switch the lights on or off so it looks like you're at home. There's a handy simulated occupancy program just for that purpose, so you don't need to do it manually.

Schedules can be created to turn lights on and off, they can be programmed to come on and off at sunrise and sunset, they can gradually dim as you fall asleep at night, and the apps are compatible with IFTTT, so events can trigger lighting changes.

The WeMo LED Lighting Starter Kit costs £49.99, and extra light bulbs are £24.99 from Belkin, but shop around, because discounts are available from other suppliers, and you can save a bit of money. Multi-packs of light bulbs also work out cheaper if you want to replace all the lights in your home in one go.

Smart Heating

LightwaveRF Radiator Valve

Controlling the heating in your home can be pretty expensive, with some systems costing hundreds of pounds. If you want to start on a budget, the LightwaveRF Radiator Valve (lightwaveref.com) is an option. This replaces the standard manual valve control you have on radiators with an automated one. It has push buttons for manual control, but like all LightwaveRF products, it can be operated remotely.

The valve requires minimal effort and knowledge to install, and it should not require draining the radiators or plumbing. The old valve head is unscrewed, and the new valve screwed down in its place. It may depend on your radiators, though, so check before buying.

With one of these valves installed, you can increase or decrease the temperature of the radiator. Having one of these in each room would enable each room in the house to have the temperature set independently. You wouldn't even need to get up off your sofa if you were feeling cold, provided you had your phone in your pocket or were sitting at your PC.

A single radiator valve costs around £49.95, but shop around for discounts.

Salus RF Thermostats And Receivers

Salus (salus-tech.com) has a mix-and-match range of thermostats and receivers, and they're reasonably priced. You need a plug-in module for your boiler (there are models for Worcester and Vaillant, for example), and you pair it with a thermostat that can be placed anywhere.

Individual components can be purchased separately, and the boiler control is around £25. Then there are various thermostats. The top of the range is the Salus iT500 Smart Heating Thermostat and boiler control. It costs £139.99, but it contains everything: thermostat, receiver, gateway, Ethernet cable, power supply and batteries. You might need a heating expert to install it, though, because some wiring is required, and it has to comply with wiring and building regulations.



▲ Nest Thermostat puts you in control of your home heating, but it's not cheap



▲ The Belkin NetCam HD wi-fi Camera with Night Vision – add it to your WeMo collection

Once set up, you can control the heating in your home using manual or remote controls. There are apps for iOS and Android phones that enable you to adjust and program the heating, and there's web browser access from your PC too.

Nest Thermostat

Nest Thermostat (nest.com) is an intelligent smart heating control system. Google thought it was so good, it bought the company. For this reason, it's worth considering, even though it's more expensive than some other systems. It consists of two devices, and one box replaces the program control box next to your boiler. The old box is a dumb controller that turns the boiler on and off at set times of the day, but replace it with the Nest Heat Link and you can then use the Nest Thermostat to control the boiler wirelessly.

The system is compatible with most boilers, but requires someone experienced with them to set it up. Nest can find a suitably qualified person to install it for you and, once installed, you can easily control the heating using an app on your phone. The Nest control can tell when you enter a room, and it learns about your home, such as how long it takes to heat up. It learns your behaviour, and while it can be manually controlled, it works out the best schedule for you automatically.

It even takes into account the weather and if the Nest is in direct sunlight, which would cause it to misread the temperature, but it compensates accordingly. It looks great and has lots of features like weather and temperature display, but it's £199 plus installation costs.

Smart Devices

Cameras And Monitoring

There are many wi-fi enabled cameras, and these are stand-alone devices that just require a wi-fi network to connect to and a power socket. The Belkin NetCam provides a VGA (640 x 480) video stream and costs £69.99, and there's an HD model costing £99.99. Both can be accessed from a mobile phone anywhere, which enables you to monitor what is happening in any room in your home. You can watch your dog when you're out, keep

an eye on your children and so on. The videos stream also has audio too.

Belkin's cameras support WeMo, so if you have Belkin lights and power switches, you can control everything from an app on your phone or from your computer. You could turn on devices remotely and then view the camera. The device can be activated by movement in front of it and an alert sent to you by email. The video stream could then be recorded.

An optional cloud service enables recordings to be triggered by movement and recorded online automatically. It could, therefore, function as a simple security system or just for fun by capturing what your pets get up to when you're out. Both netcams have night vision too.

Locks And Security

Danalock (danalock.com) has several door locks and instead of using keys, you use your mobile phone to lock and unlock the door. It's designed to easily fit most doors, and if you're reasonably good at DIY, you can probably do it yourself.

The Danalock has an auto-lock function, and the door automatically unlocks as you approach it and locks when you leave. It works through Bluetooth and Z-Wave (a common smart device connection standard).

Using a smartphone as the key opens up many possibilities, and you can tell who's entered or left the house. For example, you can see when your children arrive home from school. You can also give time-limited access to people, such as a cleaner, and you can also grant access via email or SMS and be notified when the person unlocks the door.

Smart door locks are expensive and often cost £400 or more, but there are some Danalocks on Amazon for £175.

Schlage also has a range of locks that support the Z-Wave wi-fi standard, and some of them are reasonably priced. The Schlage BE469NXCAM619 Camelot Touchscreen Deadbolt with Nexia Home Intelligence and Alarm is £189 at Amazon. The Z-Wave connectivity means you can access the lock from a phone, tablet or computer. [mm](#)



▲ Look for keyless locks with Z-Wave connectivity, like this one from Schlage



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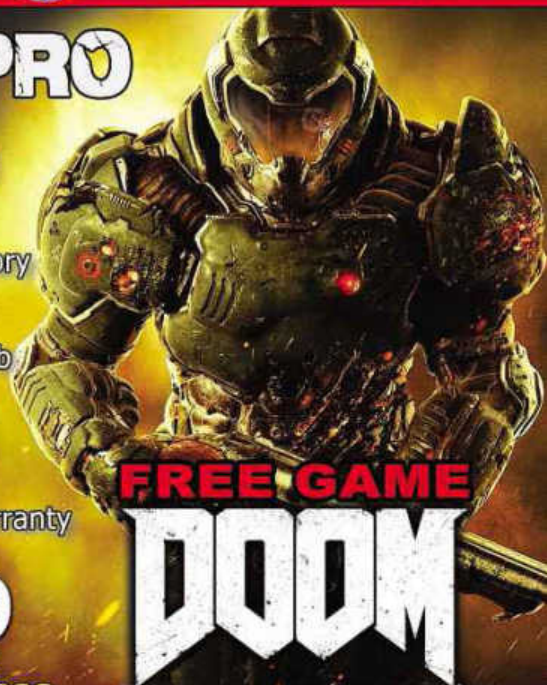
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CPU: Intel I7 6600K Quad Core
Cooler: Corsair H45 Liquid Cooing
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GFX: GeForce® GTX 1080
HDD1: 250GB Samsung EVO SSD
HDD2: 1TB Seagate 7200RPM - 64Mb
PSU: 600w Corsair PSU
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Remembering... Conventional Memory

This week, **David Hayward** tries to free up as much of his brain as possible

'Not enough memory' and 'You do not have enough Conventional Memory to run this program' were frequent messages in the early DOS days.

That *Star Trek: 35th Anniversary* game you bought over the weekend still wouldn't work because it required a stupidly high amount of conventional memory. And regardless of how you loaded the CD-ROM driver or mouse into high memory, you were always short a single kilobyte.

Conventional memory was a bit of a pain. You could load up your PC with 16MB of memory, but even the most simple game would fail to load, due to the fact that you only had 520KB of conventional memory free once you'd loaded up all the necessary drivers and programs from your autoexec.bat and config.sys files.

Most of us managed to get to grips with it in the end, having numerous DOS boot disks lying around that could load the CD driver, mouse driver, Smart Drive, network card driver, SoundBlaster driver and so on while still managing to get well over 600KB of conventional memory free. Depending on what we needed for the game or program, we could insert the appropriate disk and boot with our heavily customised start-up files.

There was a kind of mystique surrounding those folks who could get to the higher end of the 640KB memory limit with everything loaded. They were able to load the various drivers into hexadecimal memory areas that gave you a headache just to look at. And

what's more, these masters of

memory blocks could do so without the use of MemMaker, QEMM or any such memory management programs.

It wasn't all bad, though, when we think about conventional memory. This was a time when we were actually in charge of the computers in front of us. Control over a modern PC and its OS may well be an illusion, but back then we decided how much memory was used and what was or wasn't loaded.

Its History

Conventional memory was the first 640KB of a PC's memory belonging to the first megabyte of available memory. The remaining 384KB was reserved for video hardware and various optional devices, known as the Upper Memory Area (UMA).

It was a hardware limitation of the PC itself, from back in the 8088 and 8086 days, where the PCs of the late 70s and early 80s were only able to address 1MB of memory in total. Back then, of course, 640KB was more than enough for anything in the foreseeable future. After all, this was a time when home computers had 48KB or at most 64KB of memory.

Even when the 8086 moved on to the 286, 386 and 486, there still remained that 640KB barrier. Mostly it was due to compatibility with older software, but mainly it was down to costs, because redesigning the OS and the physical layout of the processor and so on wasn't regarded as particularly effective for the user base at the time.

The use of extended and expanded memory addressed the memory above the

Did You Know?

- Windows 98 didn't need autoexec.bat or config.sys, but if you had over 500MB of memory installed you needed to add MaxFileCache=512000 to the System.ini file for older games to work.
- It was possible to use the UMA without using MemMaker or QEMM. You just needed to know the actual memory addresses you were writing to.
- Using different CD and mouse drivers could free up more conventional memory.
- I once managed to get 619KB free without using a memory manager!

1MB later in the PC's life, and post Windows 95/98 we found that conventional memory rarely reared its ugly head.

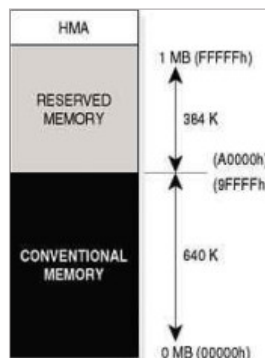
These days, conventional memory is something of legend. How many users now even think of the first 640KB of memory, let alone consider whether they can do without a mouse driver loaded?

The Good

We had control of our PC, we decided what to load and what was left out. It taught us a lot about the workings of the PC and the OS.

The Bad

Despite your best attempts, you were always short by 1KB! **mm**



▲ A basic diagram of PC memory, if you knew the memory addresses, you could work magic

Modules using memory below 1 MB:

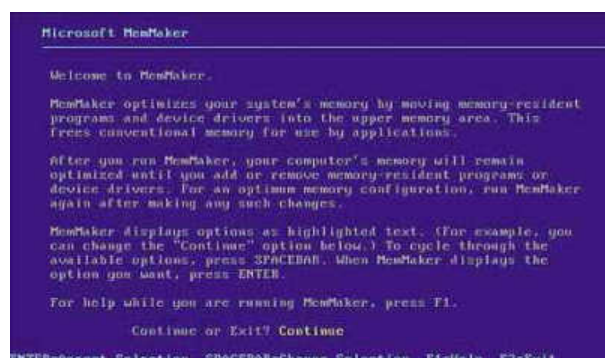
Name	Total	=	Conventional	+ Upper Memory
MSDOS	14,285 (14K)		14,285 (14K)	0 (0K)
SETVER	488 (8K)		488 (8K)	0 (0K)
HIMEM	1,128 (1K)		1,128 (1K)	0 (0K)
CDROMDR	2,328 (3K)		2,328 (3K)	0 (0K)
SMARTDR	29,824 (28K)		29,824 (28K)	0 (0K)
Free	685,488 (591K)		685,488 (591K)	0 (0K)

Memory Summary:

Type of Memory	Total	=	Used	+ Free
Conventional	653,312		47,984	685,488
Upper	0		0	0
Reserved	0		0	0
Extended (XMS)	64,946,176		2,162,668	62,783,488
Total memory	65,599,488		2,210,592	63,388,896

-- More --

▲ Free conventional memory of 605KB. Not bad



▲ MemMaker was often the final try at getting enough free conventional memory



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Alphabet Pi:

David Briddock meanders through Raspberry Pi technology from A to Z

Q

THIS WEEK: Quick start guide, quad core, QEmu and qiv

Quick Start Guide

There's a little more to getting started with a Raspberry Pi than just booting it up. So, to assist first time Pi owners the official Raspberry Pi website has a quick start guide (tinyurl.com/z3dsx9s). First the guide addresses the additional components you'll need – an SD memory card, cables, keyboard, mouse and power supply – then moves on to the process of inserting the SD card and connecting everything up. Finally, it describes the Pi boot-up, login and desktop display steps.

This online version is supplemented by a newer PDF document that aims to explain to Pi newbies how to begin in an easy-to-understand format (goo.gl/9voc9c).

Quad Core

The second generation Raspberry Pi 2 board has a 900MHz quad-core ARM Cortex-A7 CPU. On Raspberry Pi Foundation's fourth birthday, 29th February 2016, the Pi 3 appeared with its even faster 1.2GHz 64-bit quad-core chip.

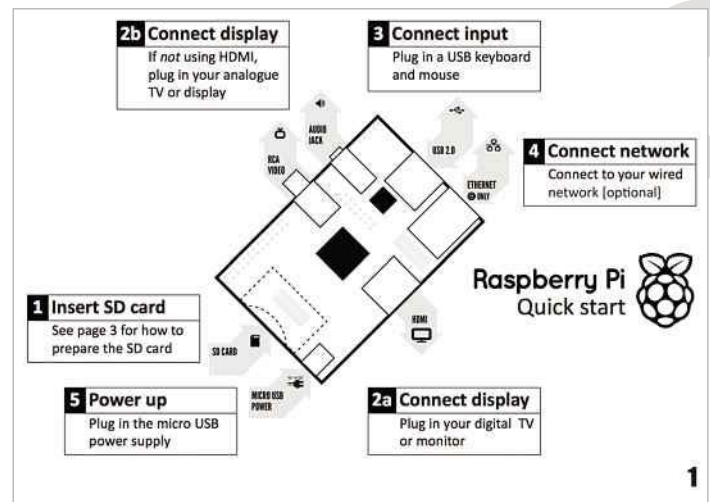
Compared to the Model B+ the Pi 2 is around six times faster and the Pi 3 around 10 times faster. So they can run most ARM Linux distributions, such as the Snappy Ubuntu Core, as well as Microsoft's Windows 10 IoT Core.

“ Unlike many virtual machines QEmu can emulate ARM processor hardware ”

Both the Pi 2 and Pi 3 are based on a Model B+ board layout, with four USB ports, 40 GPIO pins, HDMI port, ethernet port, combined audio/video jack, camera interface (CSI), display interface (DSI) and micro SD card slot. However, the quicker Pi 3 still costs just \$35, which is exactly the same price as the very first Raspberry Pi Model B.

QEmu

QEmu (qemu.org) is a high-performance open source virtual machine (VM) app. With its extensive set of configuration options it can host just about any Windows, Mac and Linux operating system. What's more, QEmu can be downloaded and installed on just about any popular computing platform.



▲ Quick start guide

Unlike many virtual machines QEmu can emulate ARM processor hardware, as well as the more popular x86 chipsets. As the Raspberry Pi's Broadcom system-on-a-chip is ARM-based, this means QEmu can run Pi-based operating systems and allow you to work in a Pi-like environment on any machine.

There's no doubt QEmu is more flexible than most other VM solutions, but getting to grips with its numerous settings is a rather daunting and time consuming proposition. However, if you download and use some GUI-based management software, like the QEmu Manager app, you can have something running in a single 10 minute session.

qiv

The powerful command line qiv (quick image viewer) tool does more than just display images. It also has a comprehensive set of move, scale, zoom flip and rotate image manipulation options, plus it can fix brightness, contrast and gamma.

Most importantly qiv works on multiple files at once via wildcard file names. For example using `'*.jpg'` will select all the JPEG files in the current folder. Images can also become desktop backgrounds in centred, tiled or stretched modes. And there's even a command to create an executable sideshow file based on a defined image file set.

To install qiv on Raspbian use the terminal command `'sudo apt-get install qiv'`. Then visit the spiegl.de/qiv website to discover its many capabilities. [mm](#)

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Component Watch

Why delete stuff when you can pick up a massive hard drive and keep it all?

If you want high-capacity storage rather than high-speed, mechanical drives are larger and more reliable than ever. For archiving media, making backups or just giving you the space you need for all your games and applications, you can't beat the raw size offered by these multi-terabyte monsters. This week, we're looking at the biggest drives on offer to see how good the prices really get.

Deal 1: Seagate Barracuda 4TB (ST4000DM000)

RRP: £122.62 / Deal Price: £97.50

Seagate makes reliable drives at any price and capacity, so that should make this one worth a little attention – especially since you get access to Seagate's DiscWizard software, designed to make upgrading to a large drive that little bit easier. A 64MB cache and 5900rpm speed are both lower than Toshiba's 4TB model, though, so if you're looking for speed over reliability or ease of use, it may not be your first choice!

Where to get it: CCL Online – bit.ly/28OPbdM



Deal 2: Toshiba X300 4TB (HDWE140EZSTA)

RRP: £114.99 / Deal Price: £98.99

The Toshiba X300 4TB drive is a 3.5" SATA-3 drive, which combines low power draw with high-capacity storage. At under £100, it's cheap for a 4TB drive, but it has extra power and performance worth paying for compared to the cheapest drives, including a 7200rpm speed. A 128MB buffer and 11.3W active power consumption are both pretty good for all-purpose drives of this size, so if you like the price, there's nothing that should put you off here.

Where to get it: Ebuyer – bit.ly/28Oj7u5



Deal 3: Western Digital Green 5TB (WD50EZR)

RRP: £174.99 / Deal Price: £155.95

Western Digital's Green drives are optimised for performance and power consumption over speed, which is why this 5TB drive

makes for an attractive purchase – especially given the price. It's actually more expensive, pound-per-gigabyte than the 6TB version (which we'll look at in a moment), but if you're interested in absolute price rather than finding good value, the 5TB version is the one to look out for.

Where to get it: Overclockers UK – bit.ly/28OilsY



Deal 4: Western Digital Green 6TB (WD60EZR)

RRP: £199.99 / Deal Price: £179.94

The 6TB version of Western Digital's drives are some of the highest-capacity on the market, and while there are versions optimised for surveillance and NAS use, the Western Digital Green line is great for desktop users, with low power consumption and low noise levels, but high speed access. And it comes with a two-year warranty, which suggests a reasonable level of confidence in the hardware!

Where to get it: Box – bit.ly/28OAYib



Deal 5: Seagate Archive 8TB (ST8000AS0002)

RRP: £215.94 / Deal Price: £189.99

Cheaper, per gigabyte, than some smaller hard drives, the Seagate Archive is one of the highest-capacity consumer drives on the market, and it's aimed at archival storage purposes (hence the name). It has a low 5900rpm speed, so it's not intended for use as a main operating system drive, but it's definitely worth picking up if you're looking for a way to hoard all your data in one place – especially when the discount is this good!

Where to get it: Maplin – bit.ly/28OB49q



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Acer Online Hack Exposes Personal Info In US

Fallout 4 Coming To HTC Vive

Bethesda confirms VR outing

We know E3 was a while ago now, but here's a bit more news from the event that we didn't want you to miss. *Fallout 4* will be given a virtual reality release for the HTC Vive at some point over the next 12 months.

Bethesda Software made the announcement at its E3

presentation, where it also gave people an opportunity to explore the game, even using Pip-Boy, in virtual reality, while a spokesperson for the studio said, "We think that VR is the perfect fit for truly immersive games like our massive open-world RPGs."

E3 also gave Bethesda a chance to demonstrate a VR tour of *DOOM*, which was nice. Virtual reality, people – it's the future.



Look! More Hanns!

Monitor touches parts normal ones can't reach

Hannspree has added to its line of touchscreen monitors with the launch of the 21.1" HT225HPB device.

The device's multifunctional, ten-point touch performance has been optimised for Windows 8 and 10, and has IPS display technology for super-wide viewing angles. The screen itself is scratch resistant, as you'd expect, while the advanced capacitive touch

control promises super-fast, sensitive response and excellent dragging performance, alongside multiple user screen interaction.

The triple-input interface is made up of an old-school VGA port, an HDMI port for full HD content and a DisplayPort for full versatility. With a couple of stereo speakers built in, there is no need for external speakers and you'd get all this for £179. Lovely. Read more over at www.hannspree.eu.



Company writes to customers to say sorry about that

Acer has admitted that lax security in its US online store has leaked the personal data of its buyers, including full payment card details, no less.

The records were taken from its store between 12th May 2015 and 28th April 2016, and while the PC manufacturer didn't give out

any solid numbers on how many customers were affected, that's quite a long period over which anything untoward could have occurred, so we're likely talking rather a lot of people indeed. Alongside card details, customer names, addresses and card verification codes have been obtained, although no passwords were. Well, that's one mildly good bit of news, then.



I very nearly bought myself a new graphics card recently, but eventually I decided to wait a bit longer before splashing out.

That turned out to be a good idea, because shortly after, AMD announced its new range of affordable graphics cards, and it looks like they'll be more powerful than the one I was looking at.

That was me sold, then. I'd put the money towards one of those instead. But now Nvidia has announced its own new products, and although they're well out of my price range, the effect their presence will have on the prices of existing Nvidia cards means it's again worth waiting.

Of course, I can't wait forever, because there will always be something better around the corner, but it's nice to actually have the problem of choice, because it's a reminder that the PC hardware market still has plenty of life in it.

And I'm just glad that I didn't buy a card just before a major price drop, because that would have been particularly annoying.

Have you ever bought a component just before its successor was released? Let us know all about it at editorial@micromart.co.uk.

Anthony

DeathFire Brings Customisation For Gamers

Board and mouse from Cougar

Gaming peripherals specialist Cougar has bolstered its line of keyboards and mice with the introduction of DeathFire, a board/mouse combo that gives hardcore gamers an affordable setup that can also be customised thanks to a seven-colour backlight. Owners can switch colours on the fly with a dedicated keyboard shortcut, while Windows key lock, media control shortcuts, mouse DPI switching and more functions all promise to make life easier.

The keyboard's hybrid mechanical switches and anti-ghosting technology combine

with the mouse's adjustable DPI, Omron switches and a 1000Hz polling rate to provide quick, accurate and reliable responses to commands.

Pitched as "real gear for real gamers", these are now available via **cougargaming.com** and various stockists, including Overclockers.



Meanwhile... On The Internet...

The term 'meme' was, as you may already know (and almost certainly will if you're a regular reader of this column), created by the oft-controversial scientist, author and humanist Richard Dawkins, in his seminal 1976 book *The Selfish Gene*. He described the term as being some kind of mash-up between the Greek word 'mimeme' (meaning "that which is replicated" and the French word 'mème' ('memory'), which should "be pronounced to rhyme with 'cream'. And he used it as a way to explain the evolution of ideas. He did this by tying that process to the tenets of biological evolution – a concept that sees an idea attempt to move from brain to brain along with all the other ideas out there, with the most popular surviving and propagating, while others fall by the wayside (tinyurl.com/MMnet20a). It also introduced the metaphorical idea that such a transfer of knowledge was a 'viral' process.

Of course, when he came up with this idea of a cultural 'survival of the fittest' battle between ideas, the good professor could surely have had no idea just how vividly the concept of "a unit of cultural transmission, or a unit of imitation" would be illustrated by the internet and its ever churning barrel of viral ideas, jokes, pictures, videos and other media. Now, his concept of a meme and the potential of ideas to act in a similar manner to viruses are part of the fabric of our culture, and he is subject to the whims of his own concept (tinyurl.com/MMnet20b).

As is the internet's way, it's adopted the meme concept, taken it to its collective bosom and morphed it into something that can be both conceptually challenging and lowest common denominator depressing. Now a *bona fide* global phenomenon and universal concept, the meme's rise to become common cultural currency among certain demographics, of course, soon attracted online 'content creators', brands and products to jump on the concept for their own gain (tinyurl.com/MMnet20c). Not always successfully (tinyurl.com/MMnet20d), let it be said.

This shift from concept to product, however, calls in to question an idea's status as a genuine meme. Is, for example, a meme still a meme when it becomes all manner of associated products (tinyurl.com/MMnet20e)? Does its inherent nature shift as it transforms from a amorphous piece of cultural transmission to a product and all the baggage that comes with that? Are they forever compromised by being co-opted into commercial ventures like advertising? All interesting questions.

Of course, as last week showed vividly, people become very possessive about ideas. So it's no surprise that people become possessive about memes – and can become highly indignant when other people don't use them properly (tinyurl.com/MMnet20f). Which brings us to the phenomenon of #Tealizard, a rather hilarious misread of the now classic 'That's none of my business' meme from 2014 (tinyurl.com/MMnet20g), perpetrated by US TV network ABC (tinyurl.com/MMnet20h).

This faux pas hit the US internet hard for a few reasons. For a start, the meme itself was bought back from the dead by basketball player LeBron James, who chose to wear a hat bearing the internet-iconic image of Kermit the Frog sipping tea (no, really: tinyurl.com/MMnet20i) after the Cleveland Cavalier's win in the last game of the NBA finals, the sport's biggest annual event. Add to that the fact that Kermit is one of the most popular icons from the last 50 years of American culture, where he is known to millions for both *Sesame Street* and *The Muppets*, and that the meme in question is largely seen to have found its origins and widest application among people of colour in the US (fusion.net/story/316936/tea-lizard) and you have an interesting melting pot of cultural ingredients.

In this heavy soup, #tealizard immediately becomes a classic example of corporate entities appearing to be getting the internet completely wrong, even if the official line, dictating that people simply did not get the Tealizard reference, was the truth (tinyurl.com/MMnet20j). This is a possible case of inappropriate cultural appropriation (something that's high on the internet's agenda at the moment, thanks to Justin Bieber, Kylie Jenner and the general state of society in America: tinyurl.com/MMnet20k) or even so-called 'whitewashing' (tinyurl.com/MMnet20l). Also, let it not be forgotten, it's become a very funny meme in its own right – one that is, sigh, now ripe to be exploited commercially itself (tinyurl.com/MMnet20m). See how complicated this 'simple' stuff gets?

Anyhoo, regardless of what ABC or any of the internet (or magazine) commentators that have weighed in on this have to say, it pays to remember that there is an innocent victim at the centre of all this. That amphibian has spoken to social media about the matter, and he doesn't appear too impressed with how his good name has been dragged through the online blender (tinyurl.com/MMnet20n)

.AVWhy?

It kind of goes without saying that the Foo Fighters' Dave Grohl is a great guy, right (although sometimes a little bit too swearsy for young 'uns: tinyurl.com/MMnet20o)? A wit, raconteur (tinyurl.com/MMnet20p), fine songwriter (tinyurl.com/MMnet20q), filmmaker (tinyurl.com/MMnet20r), troller of idiots (another NSFW klaxon: tinyurl.com/MMnet20s); we like him a lot. This video (again, some sweariness: tinyurl.com/MMnet20t), which sees him tell a tale of party peer pressure, featuring Taylor Swift, Paul McCartney, left-handed instruments and one of his most famous songs is quite the thing – and has only reinforced our affection for his seemingly down-to-earth demeanour.



Caption Competition



"The IT department heard his violin was 'baroque' so they replaced it"

Two weeks ago, we left you with this chap. Let's see what funnies you all came up with:

- **doctoryorkie:** "Never buy a cheap keyboard – they just bow."
- **D-Dan:** "Eeuw, that doesn't sound right. (Say it aloud)"
- **Think Tank:** "Looney tunes."
- **optional:** "Swipe F8 for Mozart."
- **The VFM Addict:** "Another data entry professional tells his story..."
- **doctoryorkie:** "Don't set up a wireless keyboard. They are just a fiddle."
- **doctoryorkie:** "Musician + internet = lots of graphic sax and violins."
- **blacklion1725:** "Is this Joe Hart just before half time?"
- **Boris:** "Microsoft announce the new updated Comic Relief Windows 10 Stylophone?"
- **Sawboman:** "My teacher said I was always in the wrong key; now I have them all."
- **gregb49:** "The moment Google realised that its online office dress code had been hacked."
- **antro:** "Dave was always fiddling with his keyboard."
- **Mad Malc is back:** "Stradivarius launch new keyboard range."

Some great stuff there, but our winner this week has to be doctoryorkie from the forum, with "The IT department heard his violin was 'baroque' so they replaced it."

If you have a caption for the picture below, head to the 'Other Stuff' section of our forum (forum.micromart.co.uk), or email us your funnies via editorial@micromart.co.uk, remembering to add the issue number to the email subject line.



Bluetooth 5 Unveiled

SIG announces it could be here by next year

The Bluetooth Special Interest Group has announced that Bluetooth 5 will be coming by late this year/early 2017 and that the new standard will include much better range, speed and broadcast messaging capacity. The Group has stated that extending the range will bring

robust, reliable IoT connections for full-home and outdoor use, while higher speeds will mean faster data transfer (of course). Specifically, Bluetooth 5 will quadruple the range and double the speed of low energy connections, plus increase the capacity of connectionless data broadcasts by 800%. Impressive.

Android Security Rewards Ups Ante

Program increases money per report

A year ago, Google added Android Security Rewards to its Google Vulnerability Rewards Program., at that time offering up to \$38,000 per report that was subsequently used to fix any Android vulnerabilities.

Did you know that since then the program has received over 250 reports that qualified for financial rewards? In cold,

hard cash, that means that over \$550,000 has been paid out to 82 individuals at an average of \$2,200 per reward and \$6,700 per researcher. Nicely done. And now a year on, the program has upped the amount of money that it's prepared to hand out to researchers reporting a "high-quality" vulnerability with proof of concept by a third more. Marvellous.

Snippets!

She's Back!

LonelyGirl15 Returns

Remember when LonelyGirl15 was a thing? Remember all that web chatter over the validity of video updates of Bree, before then being told the fairly obvious – that it was all staged and that Bree was just an actress? Well, she's back.

The fresh video update appeared on YouTube, spouting some nonsense about a "ceremony", the "order" and a selection process. It is unlikely to gain the kind of attention the original LonelyGirl15 videos had (YouTube is a very different place to what it was back then), but it's a curiosity if nothing else.

New Dragon Ball Game Announced

To celebrate the 30th anniversary of the *Dragon Ball* franchise, *Dragon Ball Xenoverse 2* has been announced for PS4, Xbox One and PC digital download.

The action-fighting game with MMO and RPG elements will also come with a local versus mode, with several environments to choose from to fight it out in. Running at 60fps on all platforms, you can expect smooth fighting with this one.

No Man's Sky Wins Trademark Suit

There will be no name change for the upcoming *No Man's Sky*.

While the gaming world waits to see the finished product, the latest news surrounding the title is that the game will indeed be called *No Man's Sky* after developer Hello Games won a trademark lawsuit with Sky.

Hello Games founder Sean Murray put it best in his tweet: "Yay! We finally settled with Sky (they own the word 'Sky'). We can call our game No Man's Sky. 3 years of secret stupid legal nonsense over."

Can we just get our hands on the game now, please?

Military-Grade Mobile Protection

UK launch for Guardian brand

Anyone who has ever suffered a scratch, drop or worse to their mobile phone will understand all too well the importance of protecting your handset from getting damaged.

Step forward Peli Products, manufacturer of high-performance protective cases, which is now launching the Peli Guardian Phone Case for the iPhone 6/6S/6 Plus/6S Plus, Samsung Galaxy S6 and Galaxy

Note 7. The Guardian case has been designed by the same guy behind the interior of the Ferrari F488 (ooh, get him) and comes with an advanced shock-absorption core while also being a thin little fella.

This even meets military-grade standards for protection against drops and falls, and comes in black/blue, black/grey and white/blue colour combinations. Expect to pay £24.99 from your usual retailers.



Spammer Sent To The Clink

'Spam King' pays for his crimes

Sanford Wallace is a naughty boy. Wallace, known in some circles as the 'Spam King', admitted last year to fraud in connection with electronic mail, which pertained to his sending of 27 million spam messages on Facebook.

For the scale of his spamming, in which he admitted to spamming hundreds of thousands of Facebook users between November 2008 and March 2009, Wallace was sentenced to two and a half years in prison and fined a mighty \$310,000. The US Department of Justice wrote in a statement that, "Wallace admitted he opened a

fictitious Facebook account in the name of "David Frederix" to test his spam messages and created an automated process to sign into a Facebook user's account, retrieve a list of all of the user's friends, and then send a message to each of the user's friends' Facebook accounts."

The message itself tricked users into following a link that was apparently sent by a Facebook friend, but Wallace knew that it was just to boost clicks to sites the users were sent to, earning him money for directing traffic that way. Anyway, he's certainly paying for his spamming now.

IBM Watson Drives 3D Print Driverless Car

Seriously

Well, this is quite the development. IBM Watson has been placed in control of a 3D-printed driverless car, which is not a sentence we thought we'd be writing any time soon.

The electric car, named Olli, was actually developed by Local Motors, and it uses IBM Watson's IoT for Automotive software to enable passengers to talk to the car. That's clearly quite an important aspect of any driverless solution, and people

can also ask it questions about the surrounding area, local attractions etc.

The Olli can carry up to 12 people, and it's currently being tested in Washington, with other cities also planned for further testing down the line.



Digital Skills Crisis? There's A Camp For That

Summer coding camp gives kids a digital leg-up

Ah, kids' summer camp. A much-parodied US institution, the summer camp is, in the movies, an opportunity to make new friends, get away from parents and get into all sorts of trouble.

In the real world, summer camp is a chance for youngsters to learn some new skills, and in the case of Fire Tech Camp, it's a veritable digital dream. With the government's recent warning that millions of adults lack basic digital skills, giving children a leg-up in their tech

knowledge is surely no bad thing, and that's just what Fire Tech Camp promises to do.

The UK's leading provider of holiday tech camps for children and teenagers, it's bringing its brand of summer camps to locations around the UK, including London, Bristol and Manchester. The day and residential camps enable youngsters to learn computational thinking and coding, plus build apps and get to grips with robotics. Find out more at www.firetechcamp.com.

China Builds World's Best Supercomputer

93 petaflop/s. Count 'em

Congratulations to China for topping the latest TOP500 list of the world's top supercomputers.

The Sunway TaihuLight was built entirely using processors that were designed and made in China, and it's found itself at the top spot, because it has achieved a LINPACK benchmark of 93 petaflop/s, which equates

to quadrillions of calculations per second. It was developed by the National Research Center of Parallel Computer Engineering & Technology and has been installed at the National Supercomputing Center in Wuxi, eastern China.

Number two on the list is Tianhe-2, coming in at 33.86 petaflop/s, and Titan is third place.

HP Issues Global Battery Recall

Overheating and fire concerns

Heads up, people. If you own a HP or Compaq notebook, you may be affected by HP's global battery recall program.

The voluntary safety recall and replacement program was announced on 14th June, and the affected batteries were shipped with certain HP, Compaq, HP ProBook, HP Envy, Compaq Presario, and HP Pavilion notebook computers sold worldwide from March 2013 through to August

2015. The batteries were also sold as accessories or spares, or provided as replacements through HP Support, and HP says that the batteries pose a fire and burn hazard, because they could overheat.

HP is advising that customers check whether their batteries are affected by downloading the Validation Utility tool from HP's website. It also says to stop using affected batteries immediately. HP will provide a replacement battery at no cost.

Chieftec Eco GPE-500s

A PSU designed to keep users and polar bears happy

DETAILS

- Price: £46.99
- Manufacturer: Chieftec
- Website: goo.gl/Vebjdi
- Requirements: ATX power, suitable case

Recently, Chieftec announced the release of a new line of power supply units: the Eco range. As you can expect from the name, these are PSUs that adhere to strict environmental values and are all present and correct where European standards are concerned.

There are four PSUs in the Eco range: the GPE-400s, 500s, 600s and 700s, ranging from 400W up to 750W. The model we have in for review is the GPE-500s, a 500W ATX PSU with an efficiency rating of 85 Plus and ErP certified. The ErP Lot 6 EU (1275/2008) standard states that a computer in standby mode or when powered off must not use more than a maximum of half a watt. The Eco range complies with this ruling and certification.

The GPE-500s has 37.5A on the single +12V rail, 20A on the +5V and 21A on the 3.3V supply. Connectivity consists

of a 24-pin plug on a 400mm length of braided cable; two sets of SATA power cables with two SATA connectors on each, both terminating with a Molex and measuring 650mm in length; a single 6+2 PCIe line on the end of a 400mm length cable, and a single four-pin 12V power plug on a generous 450mm cable.

There's not much room for those with a more demanding system, but for a decent power efficient 500W system with a single graphics card, it'll certainly do the job. Users who require an extra PCIe connector, 4+4 EPS and up to six SATA power plugs will need to look to the top of the Eco range with either the GPE-600s or GPE-700s.

Included with the PSU are a number of features, such as under-voltage protection, over-voltage protection, short circuit protection, overload protection and an automatic fan speed control for the

120mm silent fan situated at the base of the chassis.

Fitting the PSU within our test system was a simple enough affair. We quite like the design of it, with it being an all-black chassis, since it matched the colouring of the system – as opposed to it being silver and standing out like a sore thumb. On the whole, it worked well, and the cable lengths to the various connectors were more than ample; the 150mm gap between the SATA power connectors was especially welcome.

The cost of the GPE-500s is pretty good to. At just £46.99, it'll happily fit the budget of most system builders who are looking to minimise the impact on both their wallet and the environment. However, this particular model is limited due to the lack of EPS and modular cabling. On the plus side, the components used

are excellent, and the overall build quality of the GPE-500s is good throughout.

The Chieftec Eco GPE-500s is a good PSU, if a little limited in terms of upgradability. But it's good for the environment and your electric bill, and it'll happily work with the majority of users' systems.

mm David Hayward

Environmentally friendly and competitively priced



▲ The Chieftec Eco GPE-500s is an environmentally sound PSU



Devolo WiFi AC Repeater

Devolo uprates its wi-fi repeater for four times the theoretical performance

DETAILS

- Price: £49.99
- Manufacturer: Devolo
- Website: goo.gl/tQ1U7V
- Requirements: AC class wi-fi access point/router

Devolo makes a fantastic selection of networking hardware that covers wired, powerline and wireless functionality. But as impressive as much of it is, there were a few obvious holes in its line-up, one of which has been neatly plugged with this AC wi-fi repeater.

The previous repeater plug that Devolo still sells for £34.99 extends an 802.11b, IEEE 802.11g or IEEE 802.11n wireless network.

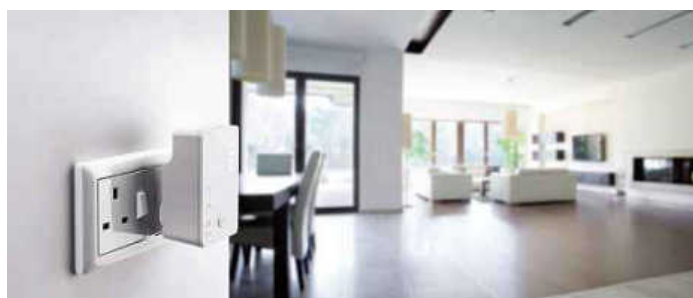
The new model is about the same size, even if it's slightly more angular looking, and obviously it supports the 5GHz AC frequencies, along with the 2.4GHz that the older design offered.

In addition to wireless connectivity, the unit also provides a single 10/100/1000 Ethernet port, allowing it to be repurposed as an independent access point on a wired network.

Deployment is simple enough. First the repeater needs to have the correct SSID and password, which it can acquire through a WPS button or via a web interface.

Once primed with that information, it can be placed at a point where the router's wi-fi signal is still strong, and it can then project that login further away from the access point in one specific direction.

If you're not sure where the best place is, the unit has an illuminating signal meter on the



front that has five bars, and you're advised to find a place where you can still get three bars of connectivity.

This is an ideal solution if you have a rear bedroom or sun lounge where the signal is weak and you'd like to boost it relatively painlessly.

The 2.4GHz spec is identical to the first repeater: 300Mbps using a 2x2 MIMO model. The AC functionality is wi-fi 867Mbps using again 2x2 MIMO.

Buy AC standards, those specs are modest AC1200 spec, but unless you're trying to stream 4K video to multiple targets, it will probably be sufficient.

And if you've got an especially big house, there isn't any practical restriction on how many of these you could deploy, within reason.

However, in those circumstances where you're tempted to have multiple relays or extenders, you're probably best off using some powerline connected wi-fi products, like the ones Devolo also makes.

What I like about this solution is that it's small and inconspicuous, ideal for deployment on a landing power socket or inside a bedroom. It also only consumes 3.6 watts typically (4.2 watts max), and you



could easily switch the power socket off when it isn't in use.

The downsides are that being so small, the antenna size is limited, and therefore the range on offer won't approach that of a dedicated access point with three or more external antennas.

But if all you need is the sort of boost that turns a dodgy connection into a reliable one, then this will do that rather effectively.

Just make sure the problem you're having isn't due to your neighbour's wi-fi using the same channels as yours, before you splash out.

mm Mark Pickavance

A simple-to-use AC-class wi-fi repeater



TP-Link Archer VR600 AC1600 Broadband Modem/Router

TP-Link gets practical about ac class wi-fi on its latest router

DETAILS

- Price: £99.99
- Manufacturer: TP-Link
- Website: goo.gl/8vAf1i
- Requirements: ADSL or VDSL broadband connection

A few weeks ago, I reviewed TP-Link's Archer VR2600, a router of mythic proportions. And now I'm back with its more calorie-conscious little brother, the Archer VR600, and it seems a generally more desirable proposition.

For less than £100, TP-Link plies you with a full VDSL modem, four gigabit Ethernet ports, dual USB ports and AC1600 wi-fi.

The integrated DSL port supports all standard DSL connections, including VDSL2, ADSL2+, ADSL2 and ADSL, allowing this to be a drop-in



Specification

- 4x 10/100/1000Mbps RJ45 LAN ports.
- 1x RJ11 port.
- 2x USB 2.0 ports.
- 3x External detachable dual-band antennas.
- WPS button, LED button, wireless on/off buttons(2.4GHz and 5GHz),.
- Power on/off button external power supply 12V/2A.
- VDSL2, ADSL2 and ADSL2+ broadband compatible.
- Wireless standards: IEEE 802.11a/n/ac 5GHz, IEEE 802.11b/g/n 2.4GHz.
- Signal rate: 1300Mbps at 5GHz, 300Mbps at 2.4GHz.
- Transmit power: 2.4GHz <20dBm(EIRP), 5GHz <23dBm(EIRP).
- Dimensions: (W X D X H) 216 x 164 x 36.8mm.

replacement for BT customers and those reselling their services, as well as also cable users through the WAN use of the Ethernet ports.

That's a major selling point, because those who want to upgrade their equipment might be looking to also enhance their connections and won't want to sling their router when they do it.

The AC1600 spec alludes to offering 300Mbps on 2.4GHz and 1300Mbps on the 5GHz range that some hardware can bond together into a unified connection. However,

as the Ethernet is only rated to 1000Mbps and overhead reduces that marginally, that's about as fast as any data can be streamed to a single connected device.

Performance on this equipment was generally very good, though it didn't seem very aware of other wireless hardware and initially sat on exactly the same channels as my existing BT setup on both 2.4 and 5GHz ranges.

Why it picked this when other frequencies were unused is inexplicable, but



had connected to the internet. That meant it couldn't set the internal clock or check for firmware updates. Again, with so many parameters available to alter, these things are relatively easy to fix, but they should just work by default for the majority of customers who aren't networking experts.

VDSL modem, critically. That should make the Archer VR600 a natural choice for anyone wanting to upgrade to AC wi-fi.

There is a blot on TP-Link's finely considered landscape, however. It comes in the shape of BT's new Smart Hub, with no less than seven antennas for a retail price of £129.99.

“ Robustly made, relatively small as these things go and wall mountable ”



hopefully a firmware update will fix this tendency.

For those that like to tinker, TP-Link has pandered to your needs with one of the more comprehensive web interfaces I've seen on a router. For casual users, it's provided a 'Quick Setup' that gets you connected, then a Basic mode that gives you more control, and an 'Advanced' mode for those who want to configure VPNs, NAT forwarding, bandwidth controls and a million other features.

In addition, the router, like other Archer routers I've seen in this generation, can be used in three operational modes: DSL modem router, 3G/4G router and wireless router. That 3G/4G mode requires an additional 3G/4G dongle, which TP-Link sells separately.

My only complaint about these modes is that when I used wireless router mode, it worked for connected wireless and wired devices, but internally it wouldn't accept it

Most users won't run into these idiosyncrasies in standard usage, thankfully.

What they might well experience is the slow speed of the USB ports on this router. For whatever reason, both of them are only USB 2.0, limiting its usefulness as a media distribution tool, unless you're prepared to detach the drive/flash key and do all the file transfers directly on your PC. Surely it should have been possible to make one of them USB 3.0 at the very least?

Also, they're both placed at the rear, when there was a perfect position on the right side (facing) for one to be placed for easier access.

The things TP-Link got right in this design are that it's robustly made, relatively small as these things go and wall mountable. The basket-weave finish on the top half is an acquired taste, though it does allow for plenty of fanless ventilation.

You can buy an AC1600 router for this price, but generally not with a built-in

Existing Infinity customers will be able to get it free for renewing their contract or £50 without renewal.

In that environment, as generally good as the VR600 is, it might have a hard time convincing people, especially BT customers, to part with hard cash for it.

That's a shame, because for lots of people this does enough AC-class wi-fi without going channel-bonding bonkers. **mm**
Mark Pickavance

A router/modem that offers affordable AC wi-fi



Kingston KC400 SSD

Performance and enterprise class features? Sounds good to us

DETAILS

- Price: From £62
- Manufacturer: Kingston
- Website: goo.gl/ycOUCS
- Requirements: Spare SATA 6Gps connection for best results



The recently released Kingston SSDNow for Business range consists of three main drives: the V300, KC380 and the KC400.

The KC400 and, indeed, the SSDNow for Business line is designed for enterprise client workloads, delivering constant performance and a high degree of stability for use in mission critical systems.

It comes in a range of capacities, from 128GB through to 1TB (the model we have for review is 256GB), and it features elements such as end-to-end data path protection, SmartECC, SmartRefresh and a new Phison PS3110-S10 controller.

The controller is quite the talking point here, with a quad-core processor dedicated to the management of the flash

memory, a 256-bit AES encryption engine and eight channels to the flash NAND. Its list of features goes on, with a power fail circuit that'll push data from the memory to the NAND in the event of a loss of power and the ability to

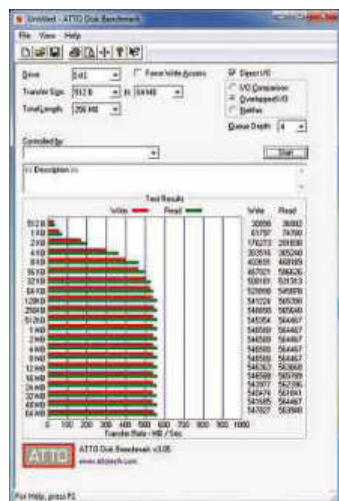
The benchmarks were certainly very good, as expected given the advanced controller and type of flash NAND used. Our ATTO benchmark revealed a write speed of 303MB/s and write speed of 365MB/s on the 4KB

Prices of the KC400 range from £62 for the 128GB model, up to £290 for the 1TB model. The 256GB version we had for testing is priced at a reasonable £92, which isn't too bad for this level of performance, as well as the extra features. It's also worth mentioning that the KC400 range comes with a five-year warranty too.

The Kingston KC400 is a great SSD and one that'll put some spring back into the system you install it in. From the business point of view, the KC400 is probably one of the best buying decisions you could make.

mm David Hayward

“ It's exceedingly clever stuff that Kingston has implemented here ”



recognise when a power failure is imminent so it can safely prepare the SSD. It's exceedingly clever stuff that Kingston has implemented here.

The review pack we received was the SSD upgrade kit, so it came with a 2.5" USB enclosure, 3.5" mounting plate, SATA power and data cables, and a code for downloading the latest version of Acronis True Image HD. Basically, this is everything you'll need to get the SSD fitted and running as the main system drive or as part of a collection of drives.

test. The higher-end 64MB test was equally impressive, with a write speed of 547MB/s and a read speed of 563MB/s.

The obvious benefits for business and enterprise systems lie with the advanced controller and its features, but running the KC400 on a home built PC will greatly improve your system's performance – plus you'll get all the extra business benefits too. It's probably overkill for a home system, admittedly, but for these read and write speeds it's something we're happy to use.

Extremely quick and an excellent foundation for any system



ViewSonic VX2757-mhd

Who says a good monitor has to cost an arm and a leg?

DETAILS

- Price: ~£155
- Manufacturer: ViewSonic
- Website: goo.gl/KT1gqR
- Requirements: HDMI, DisplayPort, VGA output, compatible AMD card for FreeSync technology

ViewSonic's VX-range of monitors are a pretty impressive bunch to behold.

There are countless versions that cater for the professional, casual consumer and gamer alike, with a choice of screen sizes and technology on offer too.

The VX2757-mhd is toward the upper end of the VX-range. With a large 27" TN LED panel, a typical contrast ratio of 1200:1 and a dynamic contrast ratio of 80,000,000:1, 170° viewing angles and an average response time of 1ms, this is one of those aforementioned impressive monitors.

It's mainly geared toward gamers, with AMD FreeSync technology, black stabilisation, gaming mode hotkeys, flicker free and a low input lag features. However, casual users can equally enjoy the benefits of these features without having to engage in the latest first-person shooter.

Connectivity is adequate, with HDMI, DisplayPort and VGA and a couple of audio ports to service the built-in (and rather weak) 2W speakers.

The design of the monitor is generally good. The build quality is top-notch. ViewSonic does have a



▲ The ViewSonic VX2757-mhd produces a pretty good screen output



▲ We're not fans of the glossy plastic everywhere, but for £155 it's worth the dust

reputation for producing some pretty fine screens, and although this isn't one of the company's upper-end IPS screens, there's still a fine degree of craftsmanship on show. Sadly, there's plenty of glossy black plastic, both on

the bezel, other parts of the monitor and the base. While okay, it's something of a dust, cat hair and fingerprint magnet. As long as you can keep up with the housework, though, it shouldn't present too much of a problem.

The image quality is excellent. Despite it being a TN panel and lacking ViewSonic SuperClear technology, it offers a high level of sharpness, with bright and accurate colours. The no-input lag and in-game enhancing technology also seem to be spot on, at least as far as our eyes could discern. We certainly never had any problem with the collection of games we put it through.

One of the best things about the ViewSonic VX2757-mhd, however, is the price. While it's wonderful to have a curved, super-sharp monitor in front of you, it's not particularly kind on the wallet. Thankfully, the VX2757-mhd comes in a rather palatable £155 – or thereabouts – which means you could happily have a dual-screen setup for less than the cost of a single all-singing-all-dancing model.

This monitor might not set the world alight with its specification, but it's a good screen for everyday work and play, and the low cost is hard to ignore.

mm David Hayward

A good monitor at an even better price



Arctic Liquid Freezer 240

Superior cooling with this extreme unit

DETAILS

- Price: £70
- Manufacturer: Arctic
- Website: goo.gl/tmVx1B
- Requirements: Intel Socket: 2011(-3), 1150, 1151, 1155, 1156. AMD Socket: AM2(+), AM3(+), FM1, FM2(+). Up to 300w TDP

Arctic has a fine reputation within the PC component cooling industry. There are ample air coolers on offer, but at present Arctic has just two AIO liquid cooling solutions: the Liquid Freezer 120 and the Liquid Freezer 240.

The Liquid Freezer 240 is a large quad-fan, all-in-one liquid cooler designed for use on Intel Socket 2011, 1150, 1151, 1155 and 1156 processors and AMD socket AM2(+), AM3(+), FM1 and FM2(+) processors.

It's a higher-end CPU cooler, with a large 270 x 120 x 38mm radiator and a matte-black steel chassis. There are mounting points on both sides of the radiator for fitting a pair of supplied 120mm fans, and when all four are fitted correctly on opposite sides of the radiator, there's a far greater airflow achieved than with a conventional dual-fan setup.

The pump is connected via two rubberised hoses measuring 326mm in length – more than enough to help you position the radiator and pump in most systems. The 82mm circular pump head has a large copper contact plate, with a black glossy plastic cap, complete with the Arctic logo, covering the top of the pump.

Aesthetically speaking, the design works well. The build

▲ The Arctic Liquid Freezer 240's four fans and large radiator make for far better cooling

quality throughout the entire thing is certainly well above that of most liquid coolers we've come across, from the pump through the tubing to the radiator and the fans. Arctic has also included all the various backplates, mounts and stands needed to fit any of the compatible CPU sockets. There are even a few cable ties thrown in for good measure. You also get a sachet of MX-4 included with the kit, but we didn't have any in the box that arrived to us, most likely because a previous reviewer removed it.

As for performance, the Liquid Freezer 240 performed magnificently. The i7-4970k stock test at 4GHz produced a temperature of just 21°C. Overclocking to 4.4GHz increased the temperature to 51°C. Both of these temperatures are superb and will offer some comfort when you start to increase the clock

speeds. Incidentally, the Liquid Freezer 240 only draws 2W when in use, so it's quite an efficient system for those counting the number of watts consumed.

The noise levels were extremely low too, even when under full load, and benchmarking the CPU with CPU-Z, the ambient noise barely went beyond that of a whisper. In fact, the 140mm case fan we had installed was louder than the entire Liquid Freezer 240 with the four fans fitted.

Fitting the cooler was reasonably easy, but we did have some problems when it came to placing the large radiator. However, that was purely down to the fact that we only had a fairly compact PC case to test it with. Otherwise the procedure went without any problems.

For those who are serious about keeping their processor as cool as possible and who



have enough space within their cases to accommodate the large radiator, the Arctic Liquid Freezer 240 is an exceptional cooler.

It's easily one of the best we've ever tested, and it's also competitively priced at around £70. Overclockers and systems builders take note: Arctic has just become your best friend.

mm David Hayward

A superb, high-end liquid cooling solution



Magix Video Easy

Edit the easy way with this capable editing software

DETAILS

- Price: £ 29.99
- Manufacturer: Magix
- Website: www.magix.com/uk
- Requirements: Intel Core 2GHz processor, 4GB of RAM, 2 GB disk space, Windows 7 or later

Arguably, Magix has the most comprehensive range of editing software available today, covering type of user, from the rank amateur to the professional videophile. Yet there are times when you simply want to get your footage from the camera to the screen, in the quickest and simplest way possible. That's why it's introduced this latest product, imaginatively titled Magix Video Easy.

I guess the name says it all, so let's see what you get for your money and go through what it can (and can't) do for you.

After launching the program, you'll see the familiar layout, with a timeline (or storyboard) at the bottom of the screen, and a preview monitor above this, with the content, effects and adjustment panel on the right. This is a fairly standard arrangement that, to be fair, is presented in a very unintimidating fashion, which is an important consideration for those new to video editing. Yet I've quickly realised that the product is not hamstrung by a lack of features, which can sometimes be the case with so called 'easy to use' software.

Although I'm very familiar with video editing, I must say working with Video Easy is quite refreshing, to the point where it



▲ The package includes a good range of effects.



▲ Titles and captions are simple with Video Easy

would be easy to ask "Why have I bothered with all these complex products in the past?" Well, the answer to that is because I've had the opportunity to do so, and I do like to spend far more time than is necessary. Yet sadly these extra tweaks and nuances I lavish on my productions are rarely even noticed... that very effective picture in picture or meticulously timed fade between shots that took me days to create... totally wasted!

But being more serious, it's easy to forget that the content is the most important part of any production – at least for someone creating home videos of family events or holidays spent in far flung corners of the world. That's why Video Easy has the mix just right. It's quick to use, has a fine range of transitions,

allows you to quickly remove superfluous footage and can output to just about any format you're likely to need, including uploads to YouTube. It also has a rudimentary title editor, a comprehensive colour correction dialogue and quite an effective image stabilisation system. This takes out the camera shake that inevitably occurs when you're panning or zooming. It's not as good as some of the dedicated commercial products, but if you consider you could pay more than the cost of Video Easy for such a product, it's a very useful addition.

Video Easy also includes a range of effects templates, including camera effects like zoom and pan, creative effects like old movie, sepia or black-

and-white, and tracking shots. Once again, there is no skill needed to apply or remove these; you just drop and drag them onto the clip you want to affect. Although you can add these to movie clips, some of them are more effective on still images, where they can mimic real movement.

As you might expect, the package includes a wide range of transitions, covering standard wipes and fades, a full selection of 3D animated fades and a few complex blurry transitions that are a bit wacky for my tastes. However, tacked onto the transition menu are a range of animated intros and outros that are brilliant, adding a real spark of professionalism to your productions.

When your production is finished, a single click will export it to your chosen format. If you decide on traditional formats like DVD or Blu-ray, there are more than 50 predefined menu templates for you to choose from. They're content themed and use the clips you originally defined as chapter markers.

Finally, if you'd like to try Video Easy, there's a free 30-day trial version on the Magix website.

mm Joe Lavery

Perfect for producing professional looking videos quickly



GROUP TEST

Gaming Monitors

Your average monitor may well be capable of playing the latest games and they'll no doubt look as good as you would expect. But get your hands on a gaming monitor and you'll notice a huge difference in the quality of the image produced.

Gaming monitors are a special breed and when done right they can really make a big difference to not only your games but also your everyday computing tasks.

Gaming Monitors

Acer G276HLA 27" Monitor

DETAILS

- Price: £135
- Manufacturer: Acer
- Website: goo.gl/xY3J0d
- Requirements: HDMI, DVI or VGA output

Acer has a reputation for producing cheap and cheerful monitors, but it often goes unnoticed just how good its products can be. While the majority can't compete with the likes of BenQ, Philips or Iiyama, if you look hard enough you can find some cracking gaming screens.

The Acer G276HLA is one such monitor. It's a larger than average 27" TN panel, with a decent enough 2ms response time, HDMI, DVI and VGA inputs, along with a dynamic contrast ratio of 100,000,000:1. Viewing angles are 170° on the horizontal and 160° on the vertical, which aren't up to IPS sort of standards but are good enough for most gaming experiences.

The build quality is okay; there's a 0.5" glossy bezel around the screen, with the OSD controls located in the bottom right-hand corner, together with the power. Connectivity around the back of the monitor is easily accessible, and there are the relevant holes for VESA mounting, should you wish. Ergonomically speaking, it's not the best of the group; with a tilt of just -5° to 15°, it lacks the height adjustment we see in the BenQ monitor, and the pivot and swivel from the likes of the Philips.

The included stand is a four-point cross that slots up into the bracket around the back of



▲ The Acer G276HLA is a decent enough 27" screen



▲ True, it's only an entry-level gaming monitor, but it's cheap and it works well

the monitor, then is screwed in place. This makes it quite a solid foundation, but it doesn't impede the monitor's adjustable angle in any way. It's also surprisingly light, weighing in at around 4.5kg with the stand in place, which isn't too bad considering it's not the thinnest panel we've ever come across.

We found the G276HLA to be a bright, clear monitor with reasonably good colour reproduction. The 2ms response time is also good for gaming, but it also means there's very little eye strain when spending long hours in front of a Word document or CAD package.

Although good, the Acer G276HLA is, on paper, a fairly average monitor. What lifts it slightly, though, is its sheer size, the 2ms response time and the £135 price. Because of these combined points, the Acer G276HLA scores somewhat better than expected.

It's certainly cheap, the second cheapest in the entire group, but it's also not that bad. True, there are much better displays, but there's enough here to satisfy light to medium gamers. And the large screen counts for something.

It won't win any awards, but this a monitor that will do its job reasonably well and at a great price.



Iiyama GE2488HS-B1

DETAILS

- Price: £109
- Manufacturer: Iiyama
- Website: goo.gl/17TyNt
- Requirements: HDMI, DVI or VGA output

Iiyama monitors once enjoyed an air of exclusivity back in the old CRT days.

An Iiyama display on a desktop usually elicited a response along the lines of "Ooh, you've got an Iiyama."

But things are a little different these days, although the company still seems to have a good footing in the industry. Among the usual desktop models are the newer G-Master Gaming series, and the GE2488HS, known as the Black Hawk ('no evil shall pass', apparently), finds itself in the middle of the range.

This is a 24" TN LED 1920 x 1080 panel with a response time of 1ms, a dynamic contrast ratio of 12,000,000:1 and perfectly adequate viewing angles of 170° horizontal and 160° vertical.

Connectivity consists of HDMI, DVI and VGA, with audio in and out ports for the rather poor 1W built-in speakers. Sadly, there's no DisplayPort, which may deter some gamers or, of course, those with DisplayPort-only graphics cards.

Despite it being a fairly recent gaming brand, the GE2488HS doesn't feature any of the newer Nvidia or AMD GPU enhancement modules. Instead, it offers a Black Tuner, which adjusts the viewing in shadowed areas of a game to give you an advantage. Furthermore, it uses flicker free and low blue light technology and an Overdrive

▲ The Iiyama GE2488HS Black Hawk is a new gaming monitor



▲ It's quite dull under the Iiyama polish

technology, which helps eliminate motion blur.

From the point of view of someone playing games in front of the Black Hawk, it's certainly good enough. There's a decent level of colour depth, and the image appears bright and reasonably sharp too.

Build quality is okay too. There's a moderately sized bezel of around 14mm surrounding the screen, which thankfully isn't too glossy. The ergonomics are fairly basic too, with just a tilt of -2° to 20° and no sign of height adjustment or other such features, although there are



VESA holes for wall mounting. Despite that, it's a well constructed monitor and one that'll last the rigours of a gaming household.

While the Iiyama GE2488HS is branded with a gaming label, it's quite a bland and average monitor underneath. It's a better quality screen than the Acer model, but it's still only the entry level in the specific gaming class.

One redeeming quality the Iiyama GE2488HS has over the other monitors in this group is the price. At just £109, it's the cheapest monitor we have here, and although it lacks some of the gaming flair that the BenQ and Asus models may well display, it's really not too bad.

Gaming Monitors

BenQ XL2730Z

DETAILS

- Price: £450
- Manufacturer: BenQ
- Website: goo.gl/BQaei8
- Requirements: HDMI, DisplayPort, DVI or VGA output. Compatible AMD card for FreeSync

Next up is the XL2730Z LED 27" TN panel, a professionally designed gaming screen that's capable of a maximum resolution of 2560 x 1440 at 144Hz. It offers an excellent 1ms response time, along with a dynamic contrast ratio of 12,000,000:1.

There's support for FreeSync AMD Radeon cards, to eliminate screen tearing, BenQ's own motion blur reduction technology, and 20-level colour vibrancy settings. And you'll also find the highly acclaimed BenQ eQualiser technology, which lightens the shadowed and dark areas of a screen for better clarity.

One of the major features of this model is its impressive ergonomic design. It has a fully adjustable height stand, with a measured red-coloured scale indicator of 14 settings, along with a scale for the screen tilt and swivel.

The XL2730Z also features a wired remote puck-shaped control that will bring up the on-screen menu, with five buttons surrounding a scrolling wheel; it even has an indented docking space built into the monitor stand. Furthermore, there's a pull-out headphone hook, a carry handle at the top of the stand, and a large hole at the bottom of the stand to keep those annoying cables as tidy as possible.



▲ The BenQ XL2730Z1 seems to have everything you'll ever need from a gaming monitor



▲ While amazing, it's really quite expensive



The XL2730Z's connectivity is superb, offering a pair of HDMI ports, a single DVI, DisplayPort and VGA. It also offers a mini-USB port for the remote to plug into and a further USB type-B input for the side-accessed two-port USB 3.0 hub located just below the headphone retractable hook.

The screen quality is excellent, certainly more than enough for dedicated gamers. The image displayed is colourful and vibrant, and when used in conjunction with the eQualiser technology, it really brings out the best in any game, photo or video.

The FreeSync AMD technology works a treat. We noticed that sections of the cut-scenes in *Assassin's Creed: Syndicate* had some tearing on a standard monitor and some of the other gaming monitors in this group. But on this screen, with the FreeSync active through the DisplayPort, everything was smooth.

The FreeSync module was a good move on the part of BenQ, since the technology has no licensing fees, proprietary hardware modules or communications overhead. Nvidia users don't miss out either, since this is a more than capable monitor.

But all this comes at a hefty price: £450 to be exact. While it's clearly head and shoulders above the competition in terms of features, the cost is something that will undoubtedly turn away a lot of the light to mid-level gamers. Those who happily fork out for the latest GPUs, though, will surely enjoy what the BenQ XL2730Z has to offer.

Philips 272G5DYEB

DETAILS

- Price: £320
- Manufacturer: Philips
- Website: goo.gl/dsZXKu
- Requirements: DisplayPort only, compatible Nvidia card for G-Sync

While AMD users enjoy enhanced image quality with FreeSync

technology, Nvidia users have G-Sync instead, a module that works in pretty much the same way. Philips is one such manufacturer to include G-Sync in its gaming monitors.

The Philips 272G5DYEB is a 27" TN panel with a non-reflective coating, a brightness level of 300cd/m2, a maximum resolution of 1920 x 1080, a response time of 5ms, a SmartResponse time of 1ms and a dynamic contrast ratio of 15,000,000:1. The SmartResponse feature is a Philips exclusive technology, one that will automatically adjust the



▲ Although there's USB connectivity, the only other port is DisplayPort, which seems odd



▲ This monitor looks good, but it's very limited

response times for a specific application, such as gaming. The result is better viewing all round, and we have to say we were impressed with what we saw.

In addition to that, there's also a 144Hz refresh, Nvidia Ultra Low Motion Blur and of course, the G-Sync module. And if that wasn't enough, you also get a four-port USB 3.0 hub built into one side of the monitor.

Connectivity is a little odd on this particular model. Philips, in its wisdom, has decided to forego the usual range of ports and instead opted for a single DisplayPort – nothing else. While the G-Sync technology works through the DisplayPort, it seems a strange and quite limiting design to go with.

As for ergonomics, the height can be adjusted to 150mm with pivot to 90 degrees, swivel from -65° to +65° and tilt from -5° to +20°. Plus the viewing angle is an impressive 170° horizontal and 160° vertical.

In terms of the output quality, the colours were bright and vibrant, and the image was crisp and quite sharp too. The sharpness we think may have something to do with the G-Sync technology. Whatever the case, it certainly looked good.

The build quality is good too. Philips usually manufactures better than average monitors, even in its entry-level lines. The gaming G-range is certainly no exception, and while not particularly exciting, it feels solid and well made.

The Philips 272G5DYEB is an impressive monitor, but the one factor that we really don't like is the single DisplayPort connection. Although DisplayPort offers the necessary technology for G-Sync and so on, the lack of DVI or HDMI is certain to leave many gamers out in the cold. And this decision is made even more puzzling by the fact this screen costs around £320.

It's quite an omission, because you'll need to a converter or a DisplayPort-enabled graphics card, which can increase the overall cost of the entire system, even if it is just by a few pounds. Still, if you own both and it happens to also be a compatible Nvidia card, then you'll be very happy with what the Philips 272G5DYEB has to offer.



Gaming Monitors

BenQ RL2460HT

DETAILS

- Price: £165
- Manufacturer: BenQ
- Website: goo.gl/59zvWe
- Requirements: HDMI, DVI, VGA outputs

The second BenQ in the test now, and another from the company's ever growing gaming range. The RL2460HT features a 1920 x 1080 TN LED 24" panel and offers a 1ms response time, brightness levels of 250cd/m2 and viewing angles of 170° horizontal and 160° vertical. It has a 12,000,000:1 dynamic contrast ratio, and viewing angles of 170° and 160° on the horizontal and vertical, respectively.

Connectivity is good and comes in the form of three HDMI ports, DVI and VGA, as well as a headphone and line-in ports for the pair of 2W speakers. It's also quite



▲ The BenQ RL2460HT is a great gaming monitor



▲ It's surprisingly affordable, considering what it offers

ergonomic, taking a leaf from the higher-end monitors. You get a -5° down to 15° up tilt, rotation and even a 110mm height adjustment setting, complete with a scale imprinted to the monitor leg to help you make the adjustments.

The matt-black finish limits the amount of glare and fingerprints, and it's coloured with splashes of red for a more sporty effect. The actual build quality is excellent, and while the RL series isn't quite as top of the range as BenQ's XL series, there's certainly no drop in the quality of the components used.

The image quality is pretty amazing too. There was no perceivable lag, motion blur or anything like that. Any genre of game or fast action movie will look great when played on this monitor, but BenQ has also included a couple of dedicated gaming profile picture modes for FPS and fighting games.

These settings will alter the calibration of the colours and improve the sharpness of the screen to help you see more during play.

On top of this, there's also the Black eQualizer mode to brighten darker scenes without over-exposure, and there's a 20-level colour vibrancy setting to help optimise the details on screen.

As good a monitor as it is, there's no DisplayPort connection. You could argue that it's not necessary since there are already enough HDMI ports, but a lot of graphics cards are now pushing finer details through DisplayPort, and there's always an opening there to accommodate Nvidia G-Sync or AMD FreeSync technology.

Interestingly, the third HDMI port is labelled HDMI OUT. This allows gamers to record and stream their content after it's sent through the monitor, rather than before. This stops any lag

associated with recording, and the viewers see the content without unnecessary editing or time delays from the host PC or console.

The BenQ RL2460HT is a really good gaming monitor. There's plenty of features to enjoy, the display is very good indeed, it's a lot more ergonomic than most monitors available, and it only costs around £165. All in all, it ticks all the right boxes for the vast majority of gamers.



Asus VG278HV

DETAILS

- Price: £275
- Manufacturer: Asus
- Website: goo.gl/iPCsWW
- Requirements: HDMI, DVI, VGA output

Many of Asus's monitors bear the company's Republic of Gamers (ROG) branding, but others, like the VG278HV, are simply sold as 'Asus' displays.

A fairly recent addition to the already established gaming range, it's based on a 27" 1920 x 1080 TN LED panel with a 144Hz refresh rate, 1ms response time, 300 cd/m2 brightness levels and viewing angles of 170° horizontal and 160° vertical.

Connectivity consists of VGA, DVI, HDMI and an audio input for the 3W built-in speakers. Sadly, there's no DisplayPort, though, which seems like an odd omission for such a modern and recently manufactured monitor.

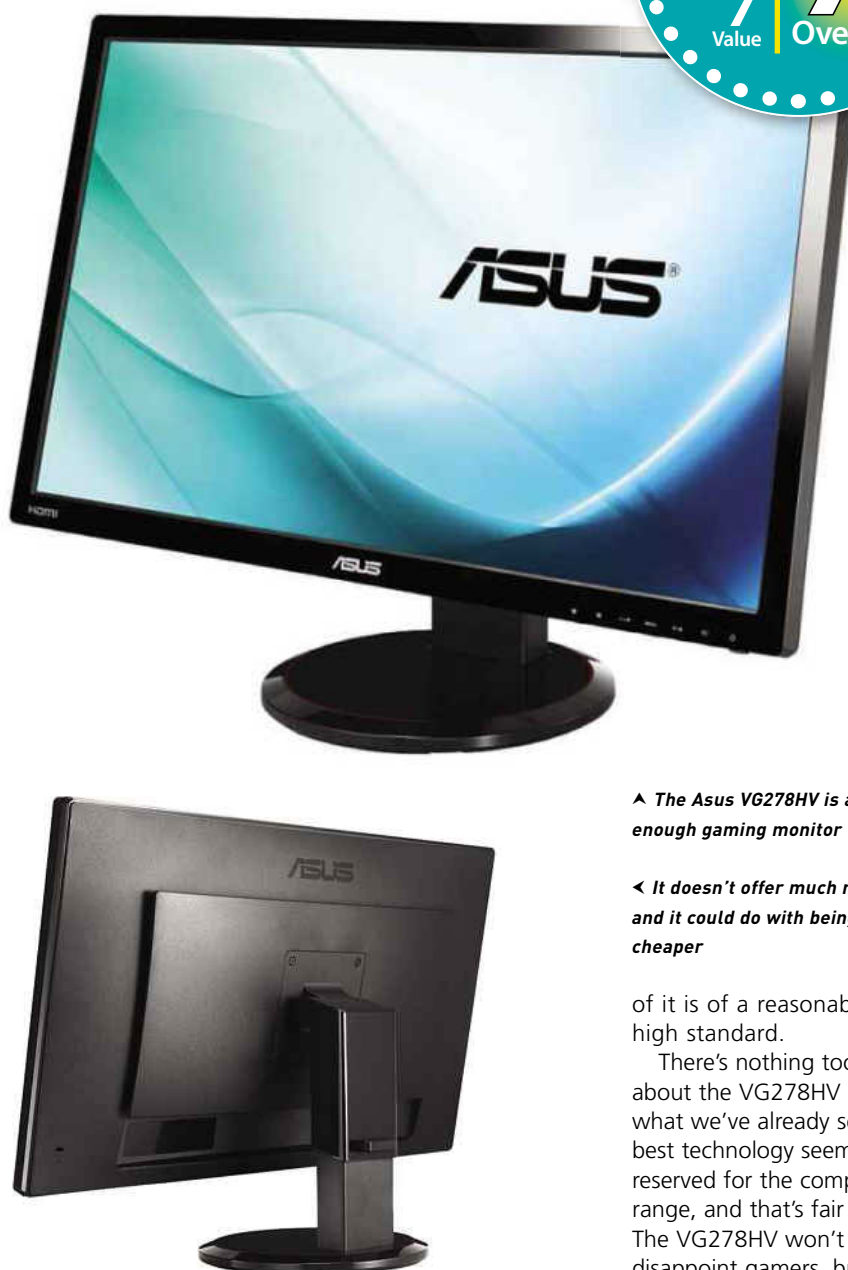
While it's lacking any specific GPU technology, the VG278HV does include Asus's Splendid Video Intelligence Technology. This, according to the specification, is a technology that will automatically adjust the image to the best possible quality depending on what's being displayed, be that a game, film, photo and so on.

In terms of ergonomics, it's actually quite well enabled. There's height adjustment to 100mm, swivel of 160° and tilt from -5° to 15°. There's no pivot, but there are VESA holes available for wall mounting.

The screen quality is great, with a good range of colours, brightness and dark levels and a clear and reasonably sharp

image. It's not as impressive as the BenQ monitors we've looked at, but it's certainly better than the Acer and Iiyama models. Gaming worked well, and although we didn't see any firm evidence that the Splendid Video Intelligence system was in use, we can't complain with what we did view.

The design and build of the VG278HV is good enough for most users too. It's not the most exciting monitor in the group, but it's well built, and there's a splash of colour on the circular base – a thin red band bordering a glossy black section. It's okay to look at, while the plastic and structure



▲ *The Asus VG278HV is a decent enough gaming monitor*

◀ *It doesn't offer much new, though, and it could do with being slightly cheaper*

of it is of a reasonably high standard.

There's nothing too dynamic about the VG278HV beyond what we've already seen. The best technology seems to be reserved for the company's ROG range, and that's fair enough. The VG278HV won't necessarily disappoint gamers, but it doesn't take best advantage of what more enthusiastic gamers would want.

The saving grace is the fast response rate and the 144Hz screen refresh, both of which are boxes worth ticking for modern gamers.

It's not too badly priced either, at around £275, but the BenQ RL2460HT is more than £100 cheaper.



BenQ RL2460HT

Although the BenQ RL2460HT doesn't have the GPU technology its sibling from the XL-series has, it's a really good gaming monitor.

It's also extremely well priced considering the amount of features you get, and the quality of both the product and the image displayed.



BenQ XL2730Z

While it's expensive, the BenQ XL2730Z has everything you'd need from a gaming monitor.

It was a tight call, though, because the Asus monitor is good too, but it needs to be a little cheaper to clearly win. And although the Philips monitor only has a DisplayPort connection, the image quality is great. If you can afford it, though, you won't go wrong with the BenQ XL2730Z

How We Tested

All the monitors were connected via HDMI or DisplayPort to either a G-Sync compatible Nvidia graphics card or FreeSync compatible AMD graphics card. We tested them with *Assassin's Creed: Syndicate*, *Elite: Dangerous*, *Doom*, *GTA 5* and *CS:GO*.

	Acer G276HLA	Iiyama GE3488HS	BenQ XL2730Z	Philips 272G5DYEB	BenQ RL2460HT	Asus VG278HV
Price	£135	£109	£450	£320	£165	£275
Screen Size	27"	24"	27"	27"	24"	27"
Dimensions	639 x 284 x 40mm	568 x 409 x 217.5mm	663 x 557 x 226mm	639 x 580 x 273mm	579 x 502 x 213mm	643 x 437 x 249mm
Weight	4.6kg	3.5kg	7.5kg	7.8kg	5.2kg	7.8kg
Response Time	2ms	1ms	1ms	1ms	1ms	1ms
No. HDMI Ports	1	1	2	0	3	1
No. DisplayPort Ports	0	0	1	1	0	0
No. DVI Ports	1	1	1	0	1	1
No. VGA Ports	1	1	1	0	1	1

Top 5

Technologies For Football

Euro 2016 is still going on, so why not, eh?

1 TV

Today, the sight of merry people cramming into pubs to collectively watch 11 men kick a bag of air around a field is a regular occurrence, but imagine what things were like before TV came along. If you wanted to watch a match, you'd actually have to attend the ground. If you couldn't afford it, then you just didn't get to watch the game.

Of course, you could argue that if you couldn't afford to watch the big teams, you'd be more likely to go see a smaller club play, so perhaps TV isn't so good for football, after all.

Whatever the case, there's little doubt that TV, of all technologies, has had the greatest impact on the sport.

2 Video Recording & On-demand

As great as TV is for watching football and other sports, if you miss the game, what can you do? Waiting for a highlights show like *Match of the Day* is one option, but what if you miss that?

Thankfully, this hasn't been a problem for many years now, thanks to a group of different technologies. First, we had video tape recorders with timers. Yes, they often missed a couple of minutes at the end and/or beginning of whatever they were recording, but they generally worked.

Then later we had digital PVRs and on-demand services, the latter of which eliminates the problem of mistimed recordings. It really is a marvellous time to be alive if you're a footie fan.

3 The Internet

If you're old enough, you might remember listening to the football scores as they were announced on the radio by the BBC's James Alexander Gordon. You might also recall being amazed by Teletext and the ability to keep track of games in real time.

But the internet made things even easier and eventually even led to games being streamed live online.

That's not all, though. The internet also made it possible to talk directly to footballers via social media, gave us access to free football news, led to probably millions of football- and sports-related blogs being set up, and made it much easier to play fantasy football, among many other things. If that's not giving 110%, we don't know what is.

4 Smartphones

Going hand in hand with the internet are smartphones. Now, no matter where you are, you can keep track of the latest football news and scores. You can even watch the games if you're nowhere near a TV.

Even if you're watching the game at home, in a pub or in a stadium, your phone is probably part of the experience. Perhaps you're using it to take photos of where you are and who you're with, or maybe you're live tweeting your responses to what's going on in the game, or perhaps you're simply wasting some time on Facebook during a particularly boring England game.

Indeed, phones can be a part of the football experience or a helpful distraction from it.

5 Goal-line Technology

It's taken a long time to be agreed on, and it's only just started to be implemented, but goal-line technology could have an enormous impact on football in the future. Just think what might have happened if it had existed in 1966, when England's Geoff Hurst fired the nation to its only World Cup victory. Would it have gone a different way? Who knows, but it's clear that huge, tournament defining moments could be decided by the introduction of this technology.

You only have to look at the Hawk-Eye system used in tennis to see how it can transform a sport. And if your team has ever been on the wrong end of a bad decision, then you'll no doubt agree that it's about time football followed suit. [mm](#)



▲ In spite of drinking lots of milk, Mr Tibbs wasn't even good enough to play for Accrington Stanley

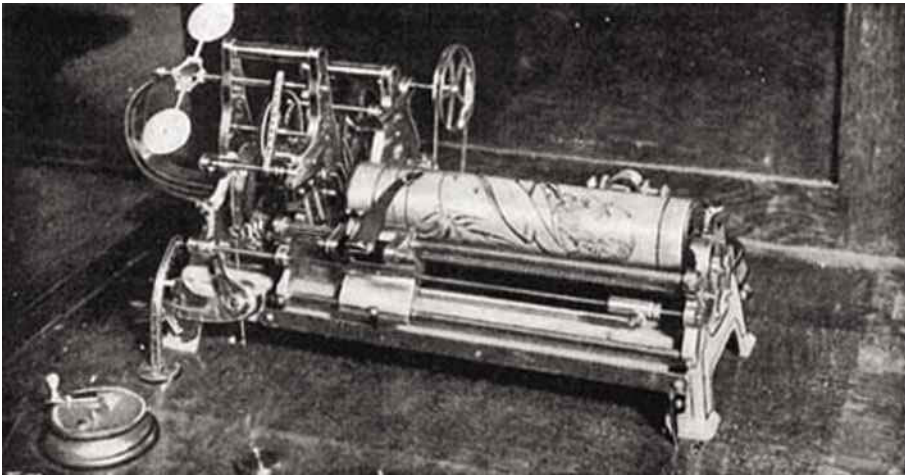


Back to the Fax

Once an important communication tool, the humble fax has died out, but why, and is it still useful?

Can you imagine a world without email? Depending on your age, the answer may actually be no. And even if you're old enough to remember such a day, email has become so prevalent and engrained in today's culture, it's hard to remember when it wasn't around. Email has made communication so easy and cheap, it's crazy to think we once had to jump through such hoops to get paperwork and other printed material to others, but this was the case. Snail mail, as it became known after the rise of email, was the tried and tested method of communication, and it came with the added time of physical delivery, but before email's dominance, there was another aid to communication, one that was around for quite some time, but which died out with nary a whimper. That communication was the humble fax.

Short for facsimile, fax, as most will be well aware, was a form of telephonic communication that could send copies of documents down phone lines, reproducing the original article via a specialised printer on the other end that would convert the



▲ It may not look like it, but this is actually an ancestor of modern fax machines



▲ Xerox Corp's Telecopier 200 from the 1970s was hardly compact

telephone information into a rather crude reproduction of the original, hence the facsimile name.

Despite its limited nature, at one point, fax machines were the only way to send documents to others in a near instant manner. This made the technology of utmost importance in business, and even to this day many companies still use it, even in the face of far more advanced options. Where did the tech come from, however? And can we use today's communication methods to keep the fax alive?

Telefax!

Surprisingly, the technology that created the fax machine as we know it actually appeared before the telephone, way back in 1846 in Scottish inventor Alexander Bain's lab. It was then improved and made into a commercial 'telefax' service in 1865, pre-dating the telephone by a decade.

“ The technology that created the fax machine as we know it actually appeared before the telephone ”

This early iteration was obviously very different in terms of technology to the fax machine we know, but the premise was essentially the same, using telegraph information to reproduce ink-based prints of the information sent. As the telephone was not yet available, it wasn't telephonic, but it used the telegraph system instead.

The telephone implementation of the system didn't come until 1881, when English physicist Shelford Bidwell worked on his 'telephotography' project, which is generally held to be the precursor to the fax machine we know today. In the following years, various inventors worked on similar technologies. In 1924, the AT&T corporation created a technology that allowed the transmission of images via electricity. This was followed by a Western Union machine that was compact enough to be used in an office.

Eventually, the fax machine shed its wired roots, and with the invention of the transoceanic radio facsimile by Richard H Ranger, also in 1924, the true early version of the modern fax was created. It was able to send actual images across great distances and famously sent the very first radio transmitted image, which was of President Calvin Coolidge. This was sent from New York to London.

The technology then blossomed, eventually allowing colour transmissions, and even satellite communication in the 1960s. In 1964, Xerox created the first commercial fax machine that used telephone lines, dubbed Long Distance Xerography (LDX). This was superseded by the Magnafax Telecopier, arguably the first real fax machine and the model that was copied by

Thermal Limits

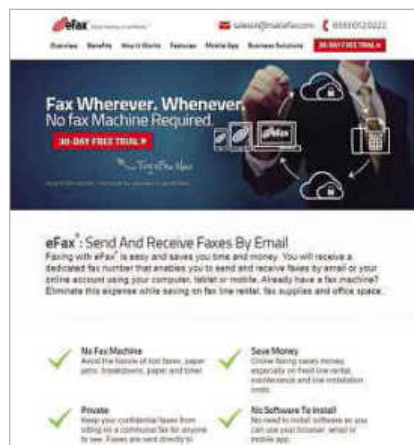
Some fax machines in general use back in the day and even now use a special kind of thermal paper. This uses a heat-based printing method instead of the more traditional ink system. Paper is heated up by the machine, with the heat leaving the printed information behind on the paper, which contains the 'ink' within. It's basically the same technology used by some receipt and ticket printers. Some thermal faxes use special thermal ink ribbons rather than special paper, but the process is similar. Ink ribbons are consumables, however, and need replacing.

The use of thermal paper means there's no traditional ink cartridges required to print information, and therefore it's found to be cheaper and more efficient, which is appreciated by users and means large-scale printing jobs don't cost the earth in ink (hence its popularity in receipts).

However, in terms of archival purposes, thermal paper is mostly avoided, because it's not a medium that ages well. Thermal paper soon begins to break down, and the ink can separate and flake away from the paper, meaning cataloguing and archiving communications and important documents is not possible. Ink-based printing is far superior in this regard, so a lot of people prefer fax machines that use more traditional ink printing methods.



▲ Fax Zero is a free, limited fax service you can use online



▲ With a virtual fax number and more than enough space to archive your communications, services like eFax are useful



▲ Myfax offers a virtual fax number and plenty of additional features for a modest monthly fee

companies around the world, who eventually got involved in the fax market. This led to the fax machine becoming a staple office fixture in the 1970s and onward, until the arrival of the internet.

E-fax

Email wasn't always the be all and end all of computer communication, and even modern PCs used fax technology for a good time. In fact, the computer market was perhaps the perfect area for the fax to grow – and grow it did. In the 1980s, computer-based fax equipment was made available and fax modem boards were fitted in millions of systems, not only in business environments, but also in the home. As computers were already connected via phone lines and didn't necessarily need paper to send and receive images, it was a perfect pairing, making the fax more useful than ever.

Of course, the arrival of email and the ability to simply attach documents to them with no need for paper quickly saw fax use wane. Emails were easier, faster and far more flexible. They also required no extra hardware. Today, fax use is minimal but does still exist, for various reasons.

Perhaps the most common reason for fax use is some countries' or companies' refusal to accept or recognise digital signatures. This leaves only physical mail or the still accepted scanned and faxed copies. It may seem a little archaic by email standards, but with so many documents in official use needing recognised signatures, it makes some sense. Even departments you'd expect to embrace new technology still use this, including some police departments, parking enforcement and other official document-issuing bodies.

Free Fax

Whatever the reasoning behind it, it's clear that, while no longer all that popular, faxes are still used for various reasons, and there's actually some use to be found for home users. There's one problem for many, though, and that's the need for an actual fax machine or PC fax card, which are rarely including in today's PC builds. These are not expensive, of course, being old tech, but good models can be hard to come by, and you'll need to buy paper and other consumables you may need. It's a lot of effort when a free email will serve most people's purposes, so few have the required hardware.

This needn't be a problem, though, and there are plenty of online fax services you can use, some of which are totally free. You don't even need a fax card in your PC to use them, but you

can send a physical fax to someone else with an real fax machine, making it easier to bypass problems with signatures and so on.

A good example of this is the free site, Fax Zero (**faxzero.com**). This site offers a totally free fax service that allows users to send documents from their PC to a destination fax machine. All you need to do is fill in the obligatory details like your name, company, email and phone number, as well as the destination name and fax number and pick your files to send. The fax can then be fired off for free.

This service does have limitations, such as a Fax Zero branding on the fax itself and a limit of three pages and a cover, as well as a five fax limit per day, but it's perfectly useful for the odd fax you may need to send. If you intend to use it more, you can pay the \$1.99 per fax, which gives you up to 25 pages, priority delivery, no Fax Zero branding and no limits to the amount you can send per day.

This kind of service is useful, but it does have limits. For one, you can't reliably receive faxes yourself, and senders may be

Secure

A big reason many people still use faxes, even with many other far more efficient means of communication, is security. Emails may be the most popular form of communication used when sending documents and other information, but it's also prone to security problems. Although rare, emails can be intercepted, and the information can be stolen. It's enough of a risk for some people and businesses to worry, and is a reason faxes are still used.

Faxes are more secure and aren't as easy to intercept – especially faxes that still use phone lines to transmit images. That's why government departments and other organisations that have to send and receive sensitive information use faxes instead of electronic mail.

If you have the same concerns and you're tired of reading about all the intrusions into private emails in the interest of advertising and targeted merchandising, faxing may be the answer for you. This may not involve an actual fax machine and reams of thermal paper, because you can still use digital faxing and free faxing services, the latter of which often boast enhanced security.



▲ Brother is one of the most popular makes of fax machine

unaware of alternatives. This makes your faxing a one-way street of sorts, which could be a problem. There are answers to this too, though.

One is the online service eFax (www.efax.com/efax-free). Like Fax Zero, this service requires no actual fax hardware, but unlike Fax Zero, this isn't a one-way line of communication. Instead, eFax actually gives you a virtual fax number that you can give out. Using this virtual number, people can actually send you faxes, either from other online services or from real fax machines, right into your email.

The pricing of the services dictates the functionality you'll get. There's a free option, but this omits the virtual number and limits you to 10 inbound pages per month. There's a free 30-day trial that gives you the full package, which includes the toll-free number, 150 inbound and outbound pages per month, unlimited storage, mobile app, electronic signature support, better security and support. If you like this package, you can then sign up for the actual service, which is \$12.95 per month.

A similar option lies with Myfax (home.myfax.com). Like eFax, this site offers a free trial of its service, which features a virtual fax number, enhanced security, plenty of storage, 150 pages in and outbound monthly limits and an app for mobile platforms. You can also use the service with up to five email addresses. After the trial, you can keep the service for £7.50 per month.

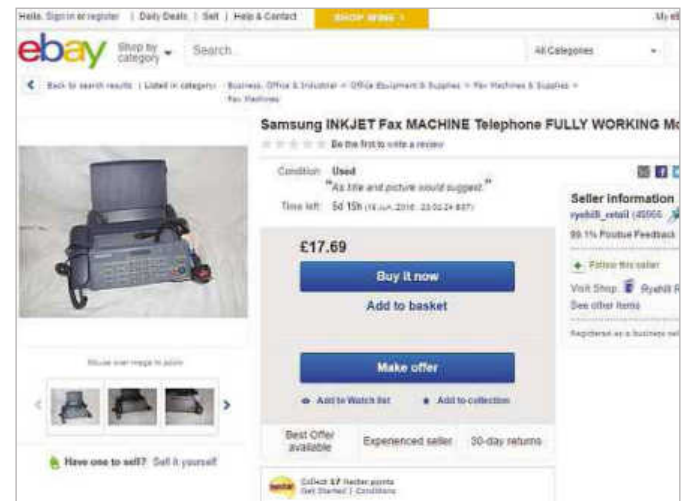
If you do a lot of faxing or want to, these services are a good option, although for only a few months' subscription, you could buy an actual fax machine.

The Real Thing

Software faxing services, especially ones that provide a virtual fax number, are a good alternative to hardware-based solutions, but if you plan to do a lot of faxing or you need it for business purposes, it may still be worthwhile using a real piece of fax hardware. For this, you'll need a fax machine or a PC fax modem card, coupled with a scanner.

Faxes are hardly in vogue these days so, as you may expect, fax machines aren't expensive. Even on commercial sites like Amazon, you can bag a decent fax machine for as little as £50-60. That may actually be a little more than you expected, sure, but these are new models. The real saver lies with refurbished or second-hand models, perfect for the home user who needs to fax every once in a while.

Of course, one of the best avenues for this is the ever dependable eBay. Here you can find all sorts of fax machines for

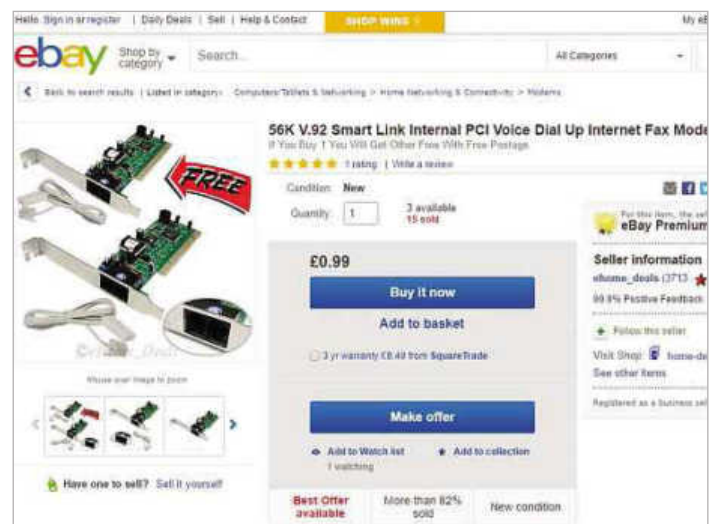


▲ You can find cheap second-hand fax machines on sites like eBay

low prices, even sub-£20 offers. The condition of machines will vary, but fax machines are fairly hardy, so you should be able to find a good deal. Auction sites are also good places to find spares and parts for fax machines, not to mention supplies like toner and paper.

What if you don't want a machine, but simply need a fax modem card for your PC? You're in luck: if you have a spare £1, you can get one or maybe even two. We found an offer on eBay for a fax modem, complete with a free second card for a measly 99p. This doesn't include posting and so on, of course, but even with postage it's about as cheap as you can get and will let you fax to your heart's content from your PC.

As you can see, although faxing may no longer be hugely popular, it's far from dead, and users still have reason to fax around the world. It's also not hard to do, being easier than ever thanks to cheap hardware and even cheaper (even free) online services. There's no reason to ignore fax options because of this, so if you ever have need to quickly fire off a physical copy of a document, remember that it's easy to do, and email isn't always the best or only option. [mm](#)



▲ Fax modems are so cheap, you can even get free ones thrown in if you look around

Automated Cleanup With Python

Mark Summerfield looks at context managers, and what they can do

One of the most useful programming patterns is to acquire a resource – a file handle, a lock or a database or network connection – do some work with it, and then release it. In C++ this is achieved using constructors and destructors, but Python (like Java) doesn't guarantee that a destructor is ever called. Fortunately, Python provides a solution: context managers. Let's begin by reading in a text file without using a context manager:

```
file = lines = None
try:
    file = open(filename, "rt", encoding="utf-8")
    lines = file.readlines()
finally:
    if file is not None:
        file.close()
```

When this code finishes we are guaranteed that the file has been closed (if it was opened in the first place), even in the face of exceptions. If an exception did occur, it would be raised after the file was closed. Here's how to write the same code in modern Python:

```
lines = None
with open(filename, "rt", encoding="utf-8") as file:
    lines = file.readlines()
```

These three lines do the same thing as the first example because Python's `open()` function returns a file object, and file objects support the context manager protocol. So the middle line says: 'call the `open()` function and use its return value as a context manager' – and name this return value `file`, so it can be accessed within the scope of the context manager (i.e. any code indented under the 'with' statement).

The 'with context-manager as' syntax is so useful that in almost every new Python release more objects in the standard library are turned into context managers. For example, the standard library's `shelve`, `subprocess`, `tempfile`, `threading`, `unittest`, and `zipfile` modules all provide functions that return context managers, and there are others.

One of Python's nicest features is that it can fully integrate custom classes and functions so that they work like built-ins, and this extends to context managers. To make a class whose instances are context managers (i.e. to make it support the context manager protocol), it must have two special methods: `__enter__()` and `__exit__()`, both with specific signatures. A special method is one we write, but never explicitly call: calls are made by Python in response to the use of particular syntax. This example ensures SQLite database transactions will be committed – or rolled back in the face of an exception:

```
class Transaction:

    def __init__(self, db):
        self.cursor = db.cursor()
```

```
    def __enter__(self): # Start transaction
        self.cursor.execute("BEGIN;")
        return self.cursor
```

```
    def __exit__(self, exc_type, exc_val, exc_tb):
        # End transaction
        if exc_type is None:
            self.cursor.execute("COMMIT;")
        else: # Exception will be raised
            self.cursor.execute("ROLLBACK;")
```

And here's how we could use the Transaction class:

```
db = None
try:
    db = apsw.Connection(filename)
    with Transaction(db) as cursor:
        cursor.execute("DELETE FROM sales WHERE pid = ?", (pid,))
        cursor.execute("DELETE FROM products WHERE pid = ?", (pid,))
finally:
    if db is not None:
        db.close()
```

The `apsw` module provides a comprehensive interface to the SQLite database, but it is not in the standard library so must be downloaded separately. We could, however, always use the standard (but less functional), `sqlite3` module instead.

When the `Transaction(db)` call is encountered, a new `Transaction` object is created (i.e. its `__init__()`), which in turn creates a database cursor. The returned `Transaction` object is assumed to be a context manager (since it is in a 'with' statement), so its `__enter__()` method is called too, which in this case begins a SQLite transaction. The `__enter__()` method's return value is assigned to the variable that follows the 'as' – in this case 'cursor'. When the code leaves the context of the 'with' statement (i.e., after the attempt to delete a product) – or if an uncaught exception occurs within the with statement – the context manager's `__exit__()` method is called.

In this case, if there was no exception we commit the transaction to the database and both deletions take place; or we rollback and nothing is deleted. In either case we preserve the integrity of our database. It is also possible to create an 'atomic' context manager class that can ensure a sequence of actions on a data structure – such as a 'dict', 'list', or 'set' either all happen, or don't happen at all (for an example, see *Programming In Python 3*, ISBN 978-0-321-68056-3).

The context manager protocol can also be used to monitor state. Here's a useful example that can be used to time little bits of code:

```
class Timer:

    def __init__(self, message, minSecs=None):
```



```
Python 3.4.3 Shell
File Edit Shell Debug Options Window Help
Python 3.4.3 (default, Oct 14 2015, 20:28:29)
[GCC 4.8.4] on linux
Type "copyright", "credits" or "license()" for more information.
>>> with open("main.py", "rt", encoding="utf-8") as file:
    for line in file:
        if "import" in line:
            print(line, end="")

import atexit
import contextlib
import io
import os
import tempfile
import time
import apsw
>>>
```

```
Python 3.4.3 Shell
File Edit Shell Debug Options Window Help
>>> class Timer:
    def __init__(self, message, minSecs=None):
        self.message = message
        self.minSecs = minSecs
        self.monotime = 0
    def __enter__(self):
        self.monotime = time.monotonic()
    def __exit__(self, exc_type, exc_val, exc_tb):
        elapsed = time.monotonic() - self.monotime
        if self.minSecs is None or elapsed > self.minSecs:
            print("{} {:.3f} sec".format(self.message, elapsed))
>>> def slowFunction(secs=1):
    time.sleep(secs)
>>> with Timer("slow function took"):
    slowFunction(2)
slowFunction took 2.002 sec
>>>
```

```
Python 3.4.3 Shell
File Edit Shell Debug Options Window Help
>>> import contextlib, io
>>> def print_odd_numbers(data):
    for i, datum in enumerate(data):
        if datum % 2:
            print(datum, end=" " if i + 1 < len(data) else "\n")
    print()
>>> print_odd_numbers(range(20))
1 3 5 7 9 11 13 15 17 19
>>> out = io.StringIO()
>>> with contextlib.redirect_stdout(out):
    print_odd_numbers(range(20))
>>> out.getvalue()
'1 3 5 7 9 11 13 15 17 19\n'
>>>
```

```
self.message = message
self.minSecs = minSecs
self.monotime = 0
```

```
def __enter__(self):
    self.monotime = time.monotonic()

def __exit__(self, exc_type, exc_val, exc_tb):
    elapsed = time.monotonic() - self.monotime
    if self.minSecs is None or elapsed > self.minSecs:
        print("{} {:.3f} sec".format(self.message, elapsed))
```

The `time.monotonic()` function returns a reference time in seconds (as a float), and is not affected if the program is running when the clocks go back. The `Timer` class can be used as follows:

```
with Timer("slow function"):
    slowFunction(args)
```

This will print how long `slowFunction()` took to run. We can provide a second argument, e.g., with `Timer("slow function", 2)`, that means the time is only printed if the duration exceeds the second argument's number of seconds. We could also, of course, time multiple statements by including them all within a single `with Timer` statement.

The `Timer` class requires us to remember (or copy and paste) the rather complex signature of the `__exit__()` method. Fortunately, the standard library's `contextlib` module provides a simpler and shorter way to create context managers:

```
@contextlib.contextmanager
def timer(message, minSecs=None):
    monotime = time.monotonic() # here we __enter__()
    yield # The body of the with statement executes here
    elapsed = time.monotonic() - monotime # here we __exit__()
    if minSecs is None or elapsed > minSecs:
        print("{} {:.3f} sec".format(message, elapsed))
```

The `timer()` function can be used just like the `Timer` class:

```
with timer("slow function"):
    slowFunction(args)
```

If we need to return a value to be the variable after the `as`, we can provide it as the `yield` statement's argument. However, this case is less convenient than using a class since we have to wrap the `yield` in a 'try, except, finally' construct. Personally, I always create a class.

The `contextlib` module provides some useful generic context managers, as we will see in a moment. First though, let's see how to delete a file that may or may not exist:

```
try:
    os.remove(filename)
except FileNotFoundError:
    pass
```

A nicer alternative is to use the `contextlib`'s `suppress()` context manager, which throws away the specific exception it is given if that exception is raised – but lets any other exception through:

```
with contextlib.suppress(FileNotFoundError):
    os.remove(filename)
```

Two other really useful context managers are `contextlib.redirect_stdout()` and `contextlib.redirect_stderr()`. These are especially helpful in unit tests since they make it easy to capture output that would normally be written to the console to check that it matches the output we expect. For example, suppose we want to test a function which prints odd numbers given a list of numbers:

```
expected = "1 3 5 7 9 11 13 15 17 19\n"
out = io.StringIO()
with contextlib.redirect_stdout(out):
    print_odd_numbers(range(20))
actual = out.getvalue()
assert actual == expected
```

We start by creating the string we expect to be output. Then we create an `io.StringIO` object called 'out'. This object can be treated like a file opened for reading and writing text, so we can call `out.write(str)` or `print(str, file=out)`. However, the `print_odd_numbers()` function doesn't know anything about our 'out' object, it contains statements like `print(datum)`, which writes to `sys.stdout`.

Fortunately, we can overcome this problem by using the context manager to temporarily redirect any output to `sys.stdout` to our 'out' object. And, once we leave the context of the `with` statement, `sys.stdout` is automatically restored and we can obtain anything written to it within the context manager by calling the `io.StringIO.getvalue()` method.

Context managers are used throughout the Python 3 standard library – and their use is growing all the time. Furthermore, as we've seen, we can easily create our own custom context managers to suit specific tasks.

The docs.python.org/dev/library/contextlib.html documentation provides examples and links to further information. In addition, that documentation covers the `closing()` context manager, which can be used for any Python object that has a `close()` method but which isn't itself a context manager, and the 'ExitStack' class, which can be used to handle a whole bunch of context managers in one go. [mm](#)



Google Unites Chrome OS And Android

David Briddock investigates one of the biggest stories of 2016



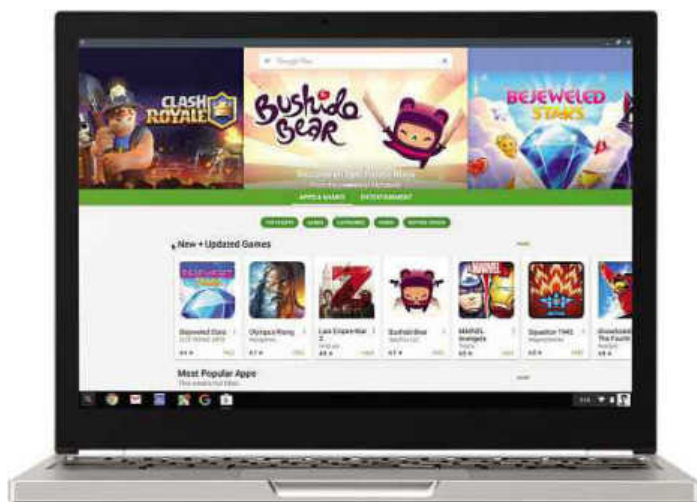
After years of speculation, Google is finally on the verge of merging the native Android app ecosystem directly into its Chrome operating system (OS).

This is one of the biggest stories of 2016. Uniting the Android and Chrome OS worlds will drive already impressive Chromebook laptop sales still higher. And it means Chrome OS devices have become a serious competitor to PC products from Apple or Microsoft.

How has Google achieved this technology feat? What sort of benefits can we expect? And when will it happen? We'll answer all these questions soon, but first let's take a look at why Chrome OS has become the fastest growing PC operating system platform.

Tablet Disillusionment

Over the last year or so, there's been a significant and sustained consumer move away from tablets. Many of us bought one of these alluring touch-friendly devices, despite already owning



▲ The Play store on Chromebook

a smartphone and laptop. Today, the initial gloss has well and truly worn off.

We invariably have a large-screen smartphone, with its essential app collection, constantly within reach. And we've come to realise everyday productivity tasks are more efficiently completed with a PC equipped with a proper keyboard and mouse/trackpad.

Consequently, many tablets are left gathering dust on our coffee tables.

Chromebook Momentum

When it comes to buying a PC platform, the flexibility offered by a laptop format makes it an attractive choice, but we're faced with a question. Do we spend a sizeable amount of money on an Apple Mac or Windows-based option, or go for one of those attractively priced Chromebooks? After all, some Chromebook models are only around £200.

Chrome OS devices are disappearing off the shelves faster than ever. In 2015, year-on-year growth was an impressive 32%. This amounts to millions of consumers, many of them new to the Chrome platform, who could choose from a wide range of devices, from over a dozen different manufacturers, in laptop, 2-in-1 laptop/tablet, desktop and TV-HDMI-port stick formats.

The US in particular is going Chromebook crazy. A recent IDC Worldwide PC Tracker report for the first quarter 2016 showed that US Chromebook shipments overtook Macs to become the second most popular PC operating system. And Chrome OS is now the number one choice for US schools.

These figures leave little doubt that this is a seminal point in the maturity of Chrome OS. Let's take a moment to review why it has become so popular.

Chromebook Allure

Chromebooks are ideal for people who want a fast, simple and secure computing experience. The user interface is based on the popular Google Chrome web browser, so anyone with experience of a modern web browser can jump straight in.

Open the lid, and within seconds you're on the web, using your favourite apps and being productive. You can also work offline, knowing everything will be synced the next time you're connected to the internet – a comforting thought when you're out of wi-fi range.



It's also a secure platform. Chrome OS updates, including security patches and virus protection software, are automatically downloaded and applied in the background, just as soon as they become available. This admin-free characteristic is a key feature for many users, and is especially popular with schools and other educational establishments.

It's true to say Chrome OS can't offer the full functionality of a Windows PC or a MacBook, but many users spend most of their time online anyway, and only need a few basic productivity programs. And those automatic updates keep adding useful new features, like voice-interface access to weather, calendar and other information via Google Now.

However, the range of Chrome OS apps isn't too inspiring. Consequently, what Chrome OS users really want is a bigger selection of apps. In particular, richly functional apps that make them more productive, improve social communication, target their hobbies and interests and so on, and they want high-quality, immersive games.

“ There'll be a complete Android Marshmallow operating system inside Chrome OS ”

Early Attempts

Even back in 2013, the Google Play store contained one million apps. Today, there are more than two million, so it makes perfect sense for Google to try to create a technology where Chrome OS users can run Android apps.

The goal was to deliver an enticing mix of Android apps and Chrome OS functionality in a seamless manner. However, it proved to be a rather tricky problem to solve.

Google has had three previous attempts. They included installing multiple codebases, a pure HTML 5 approach and a user installed virtual App Runtime for Chrome OS (ARC). These proved to be too complex, too limiting or too difficult for developers. The result was a relatively tiny list of apps, poor app performance and developer frustration.

New Approach

But Google wouldn't give up. Instead, it challenged its engineering teams to deliver a better solution. Later this year, we'll see the results of their hard work.

What's coming is a new Android app compatibility platform. For the Linux gurus out there, this platform is based on three



elements: Linux namespaces, alternate syscall tables and a shared compositor. Put more simply, this new platform offers excellent app compatibility, along with top-notch performance.

Most importantly, this solution doesn't use a virtual machine or rely on emulation. Instead, there'll be a complete Android Marshmallow operating system inside Chrome OS. This will be upgraded to Android 'N' at a later date.

“ Most Android apps should run at full speed in Chrome OS without any code changes at all ”

The app binary code is translated and executed on the fly by just-in-time (JIT) compilation software. This means most Android apps should run at full speed in Chrome OS without any code changes at all. And developers retain full and unrestricted access to the complete Android application programming interface (API), including all system services.

The underlying hardware is still managed by Chrome OS, including things like networking, wi-fi, camera and so on. This also means keyboard, trackpad and touch interaction events are sent through to Android apps, and the Google sign-on information is also shared to ensure consistent levels of user security.

Developer Tweaks

All this is music to the ears of the developer community. Overnight, their Android apps will have a whole new audience and a much greater revenue-generating potential.

As we said, the vast majority of apps should work without any code changes. Where changes are required, Google says it could take as little as one working day to sort out. Nevertheless, developers are encouraged to make a few subtle code changes to optimise the Chrome OS hosted experience.

For instance, integration with Chrome's user-friendly Backup and Restore capability would be a welcome feature, while some apps may benefit from offering multi-user sign-in on a single device, especially if they target the classroom.

There are a few things an Android app running in Chrome OS can't do. These include custom inputs, live wallpaper, home screen access, plus device and user management. In reality, this will affect only a tiny percentage of Play store apps, and even then, the code could be changed to ensure they're Chrome OS compliant.

Play Store Icon

What does Android app compatibility mean in practice? Well, the Google Play store icon will appear on the Chrome OS desktop, giving users access to over two million Android apps with a single click.

Some of these apps will already be familiar to those who own an Android phone or tablet, but they'll take on a new lease of life when paired with a larger screen, keyboard and trackpad or mouse. This is especially true for apps like Google Docs, Microsoft Office or Photoshop Mix.

The bigger screen also benefits Android games like *Minecraft*, *Candy Crush*, *Hearthstone* or *Clash of Clans*, and by taking advantage of the host graphics processor (GPU) these apps can deliver a smooth, responsive gaming experience. Even better, Android functionality includes in-app purchases, allowing gamers to add levels, buy weapons and so on.

In short, developers now have an even bigger incentive to create Play store apps, which means everybody wins – Google, developers and consumers.

Promising Demos

Demonstrations at May's Google I/O event looked promising. They clearly showed this new approach gives Chrome OS users a seamless Android app experience.

Windows appear in landscape orientation by default, but can be switched to portrait mode. You can also change the window size via the maximise and full-screen mode buttons. Messaging and other notifications appear as small pop-up windows around the edges of the desktop, and there's even a sleek, unobtrusive inline messaging window to type in your responses.

Only one Android app is live at any one time, with others placed into the 'onPause' state. However, you can have multiple instances of the same app, each in its own window. App performance seemed excellent, with games able to take advantage of the host device's central and graphic processors power.

Things get even better when full Android 'N' support arrives, with enhancements like inter-app drag-and-drop operations and a new mouse cursor API for developers to use.

Rollout

Google Play for Chromebooks will start rolling out in the developer channel with Chrome OS build M53. This build is at developer status during June and July, with the beta version appearing sometime in August. The full release of M53 is targeted for September 2016.

However, for the moment, this rollout is limited to just three hardware platforms; the Asus Chromebook Flip, the Acer Chromebook R 11 and the Chromebook Pixel (2015 model). Google says it will add the Google Play icon to a range of other Chromebooks later in 2016.

Of course, buying an official Google Chromebook is the best way to ensure full support for future Chrome OS enhancements. These devices tend to be quite expensive, but the good news is that there are more than 50 Chromebooks listed on the official Chrome OS build M53 device support web page (goo.gl/s2QMdn).

All these devices will receive Android app support via the Chrome OS auto-update capability. After all, Google's ultimate company goal is to encourage as many of us as it can to spend

“ This Chrome OS and Android merger is bound to agitate Apple and Microsoft ”

as much time as possible searching the web and using Google apps or services.

However, Google is aware that some Chrome OS users may decide they have no interest in Android apps. It doesn't want to upset these users, who are already accessing Google services on a daily basis, so they can simply change a configuration setting to switch Android app support off.

Boundary Blur

With the M53 update, your Chromebook, Chromebox, Chromestick device desktop could have web apps (like Google Docs), Android apps (like Skype) and ChromeCast-enhanced apps all open and running at the same time.

While great news, this blend of Chrome and Android apps has the effect of blurring the existing app and platform boundaries. This might confuse the buying public, who

Instant Apps

In May, at its I/O 2016 developer conference, Google surprised the keynote audience by announcing Instant Apps for the Android operating system. Instant Apps deliver a web app like run-on-demand experience to native Android apps.

Just tap a link, and few seconds later the app is running. There's no time-consuming installation process. Instead the app is dynamically loaded from the cloud in a module-by-module fashion. This also means you're always guaranteed to be running the most up to-date version of the app.

And, when Google delivers Android 'N' runtime compatibility later this year, we can expect to see Android Instant Apps running on the Chrome OS platform.

suddenly struggle to see a clear distinction of what to expect from an Android device versus a Chrome OS device.

After all, we now have an amazing range of mobile device formats: large-screen smartphones that verge on small tablet territory, large tablets that come with keyboards, 2-in-1 touch-screen devices that aim to be both laptop and tablet, and large-screen laptops marketed as desktop replacements.

It's not going to be easy to say where the Chrome OS versus Android boundary falls across all these products, and that raises an interesting dilemma for Google.

Will Google need to relaunch the Chrome OS platform with a new marketing campaign? Is there a need to create a new 'ChromeDroid' device category to clearly convey the functionality that's now on offer? And will it lead to Android tablets being replaced by Chrome-centric ones?

And what about the apps themselves? Does it make sense to use a platform moniker prefix, as in a Chrome app or Android app? Maybe it's clearer to say there's a single 'Google App' category, especially when all these apps are accessed from the same Google Play store.

Regardless of what approach Google takes, the impact of this platform merger could reverberate through its entire mobile marketplace. Consumers who see the Chrome brand applied to a large range of mobile devices might wonder why they can't buy a Chrome OS smartphone or wearable. And who knows, we may be able to do just this in a few years time.

What Happens Next?

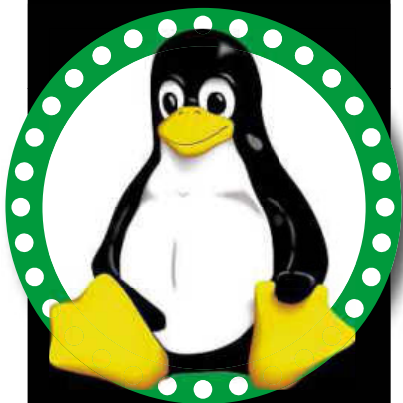
Of course, this Chrome OS and Android merger is bound to agitate Apple and Microsoft. As we said earlier, Chrome OS is already eating into their sales revenues, even without access to Android apps.

Over the years, there have been many rumours about a merger between Apple's Mac OS laptop/desktop operating system and the far less functional iOS, installed on its iPhones and iPads. Maybe the Google announcement will hasten the day this to actually happens. At the very least, we might well still see an iOS emulation mode built into a future Mac OS.

Microsoft is also suffering from buoyant Chromebook sales as it tries to encourage buyers to purchase Windows tablets and 2-in-1 devices, including its own rather expensive Surface range.

We reckon this announcement means 2016 is going to be a very interesting year. Do you agree? Write to letters@micromart.com and tell us what you think. [mm](#)





David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

Hello, Shannon

David examines the release of Solus 1.2

Solus 1.2, codenamed Shannon, has recently been released, with many improvements over the previous versions, as well as a few extras to help tempt new users to the OS as well as Linux.

Solus is an interesting Linux distro, having started life around five years ago, and it has grown into one of the best-looking and fastest distros available. Ikey Doherty and a crack team of developers have managed to, throughout all the versions from SolusOS to Evolve OS and eventually Solus, come up with a stable and exceedingly elegant-looking desktop.

As Ikey Doherty announced, "We are proud to announce the release of Solus 1.2, the second minor release in the Shannon series of releases. Solus 1.2 builds on the groundwork of 1.1 and 1.0, with continued improvements to Budgie, a huge focus on software optimisations, in addition to laying the framework for providing a performant gaming experience. Solus 1.2 furthers us on our journey to realising the future of home computing."

Desktop Glory

Solus 1.2 comes shipped with an improved version of the distro's flagship desktop, Budgie. There are many improvements with Budgie, such as optimisations for speed and stability, but it still keeps the desktop simple and elegant.

It's a compact desktop environment that give you quick access to programs, files and settings, and it uses a collective applet, notification area and customisation centre

called Raven. From within Raven, you can access the usual media tools and controls, change the icon theme, access the calendar information and access the system settings and power options, as well as restart and shutdown.

The software centre itself has been improved, which makes packages a little easier to locate, install or remove. There

packed client, along with forcing 32-bit mode.

There's Plenty More

Everything here is just the tip of the iceberg. Solus 1.2 has been finely crafted with support for eMMC storage, Kernel 4.4.13 LTS, better UEFI support and improved networking. In short, it's quickly become one of the best Linux distros available.

“ In short, it's quickly

become one of the best

Linux distros available ”

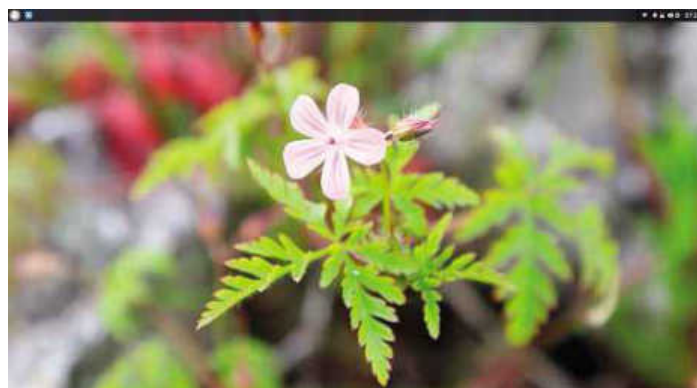
have also been numerous bug fixes ironed out since version 1.1, as well as some new additions like Firefox 47, VLC 2.2.4, Rhythmbox 3.3.1, Nautilus 3.18.5 and the Arc Icon Theme – with Solus 1.2 being the first to officially use it.

Solus 1.2 is also looking to keep favour with Linux gamers, and the team has replaced the old Steam client with an optimised version. Also, there's the implementation of the Linux Steam Integration tool, which allows you to switch between the native and pre-

Of course, there will inevitably be a few hiccups across the varied systems available, so if you come across a bug or a lack of hardware support, contact the team or get on to the community section of the Solus site to enter the Bug Tracker.

I'm quite impressed with what the Solus team has done here. This is probably my favourite distro at the moment and one that I can see myself sticking with for a while.

▼ *Solus 1.2, my new favourite distro*



Remote Delete?

macOS Sierra claims to have solved local storage problems. But Craig Grannell wonders if the feature is built on quicksand

If you're remotely a fan of Apple, WWDC 2016's keynote speech will have mostly filled you with a sense of optimism. The majority of announcements were pretty good, from the new coding app for iPad, aiming to get kids programming, through to a major overhaul of watchOS that might make Apple Watch actually worth using.

On the Mac, Apple – as predicted – rebranded OS X, which now manages to warm and irritate Mac veterans in equal measure as 'macOS'. (Mac OS! What is wrong with capital letters? And spaces? Argh!) Siri was the big news, providing Mac users with a virtual assistant that will help locate files, drag and drop, feed you weather forecasts and, apparently, tell you how to spell 'broccoli'. Elsewhere, Apple revamped Photos to surface favourite memories, figured out how iPhone owners can use Apple Pay in Safari for macOS, created a universal Desktop and clipboard, and Sherlocked a dozen apps designed to help you unlock your Mac with an Apple Watch.

But then Apple started to talk about optimised storage, and I felt a chill in the air. Storage has, oddly, become a problem again on Macs. For a while, you could largely outrun the files you amassed over time. Hard drives rapidly grew in size and decreased in price, ably dealing with expanding collections of movies, music and photos. Unfortunately, someone then threw SSDs into the mix. They're fast, slim and silent – but they're also hideously expensive. Suddenly, Apple was shipping computers with 1TB drives and charging an upgrade fee for an SSD replacement a fraction of the size. Today, standard

configurations of Mac notebooks have SSDs starting out at a paltry 128GB of space and maxing out at 1TB if you fancy selling a kidney. And even 1TB is looking a bit miserly in today's world of HD movies, high-res audio and cameras that capture enough pixels to choke a thousand Photoshop experts.

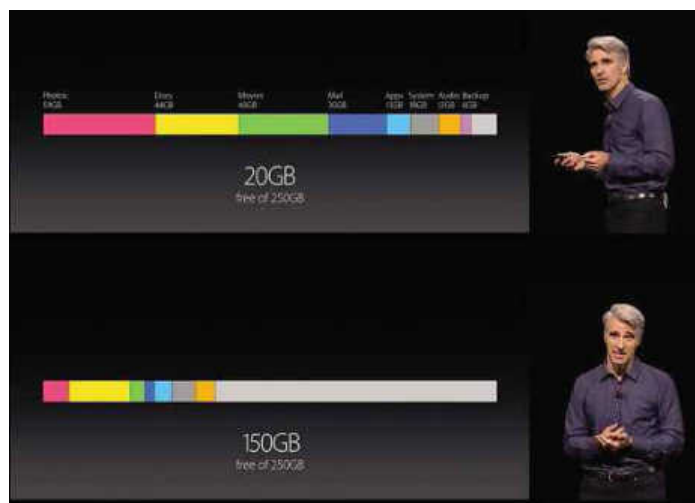
Apple's solution is, terrifyingly, iCloud. The idea is that you just let macOS figure out the files you don't need, and they're whisked away to Apple's servers. Recent files stay put, and any ones macOS has stashed away get downloaded on demand.

It's not the assumption everyone has access to always-on, blazing-fast web connectivity that worries me about this idea. It's more the potential for user error combined with iCloud being unreliable to the point you sometimes wonder if it's a highly elaborate prank we don't fully understand. When iCloud frequently loses photos, cannot accurately upload and manage a modest music collection, and often messes up basic calendar appointments, it seems a bit rich to trust everything on your hard drive to the system.

Apple exec Craig Federighi said on stage that in Apple's tests a 250GB drive with 20GB free rapidly had 150GB free when using the new system. Naturally, there was no mention of the cost regarding iCloud storage space, and iCloud nay-sayers might be concerned you could get much the same effect by randomly trashing almost 100GB of data. Certainly, backing up prior to using macOS optimised storage would be a very smart move.

Rather more pleasingly, macOS Sierra will also come with tools that should be rather less dangerous to use and yet still leave more room for useful files. They remind you to trash installers, clear out duplicates, logs and caches, in a manner that will have creators of existing clean-up utilities sobbing but potentially make the lives of typical users a little easier. However, in response to the gripes in this column, mine may well 'mistake' my entire user folder for junk.

▼ *Craig Federighi, hoping everything will go as smoothly as his bit of the keynote when users rely on optimised storage*



Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find Craig on Twitter at @craiggrannell

Mac



OnePlus Plus Plus

Ian McGurran looks at the third iteration of the mid-range powerhouse

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Mobile

Along with the likes of Xiaomi, OnePlus is the friendly face of those Chinese phones we see going for a great price but might be a bit too scared to shell out for. While not quite as cheap as, say, a Ulephone, Meizu or Cubot, OnePlus at least has a pretty good reputation in the English-speaking world, and its handsets have been well reviewed not only against its Shenzhen-type contemporaries, but also against the high-end devices of the time. It's the likes of the OnePlus that have pushed mid-range devices to offer more at a competitive price.

So we come to the third version, the cleverly named OnePlus Three, although to be fair any numerical name is going to be confusing with a company name such as that (last year's compact OnePlus X dodged that particular bullet). Previous versions have borne a passing resemblance to Google's own Nexus 5, but the Three has adopted that same familiar look adopted by the likes of HTC and, more obviously, Apple – an attractive aluminium body with curved edges, a fingerprint reader and NFC.

In terms of other specs, it's a game of two halves. The screen is a gorgeous OLED screen, but it's strictly 1080p (5") and also made with a pentile matrix. The RAM is a staggering 6GB, but you can't access it all at the moment, because OnePlus has gone with battery longevity over memory, strangely. There's also 64GB storage, but that's it – no card access. The camera has also

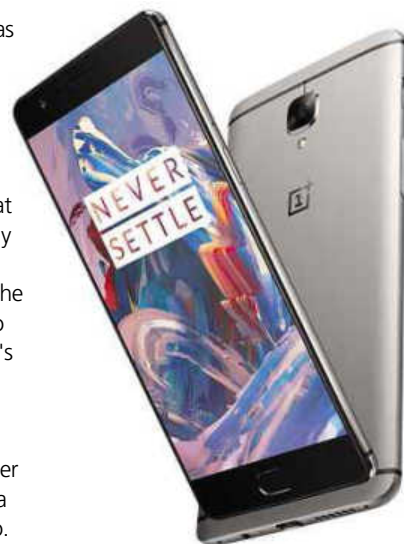
improved, it's now 16MP on the rear, though you'll now find it juts out of the body. Finally, there's some consternation over the USB-C port, and the fact the phone will only fast charge with the included charger and cable.

Let's look at the positives, though. Apart from being a very attractive device, it's also home to a blistering Qualcomm Snapdragon 820 CPU that's twice as fast as the OnePlus Two in single processor tests. This may also be in part helped by the comparatively (!) lower screen resolution for 2016, with nearly everyone else going QHD now. Of course, in day-to-day use, the resolution frankly won't be an issue, but as some pundits have pointed out, when they're inches from your eyes in a VR situation, things are a little different. With OnePlus making its own VR accessories, it's a bit odd QHD wasn't used, although cost is likely the factor.

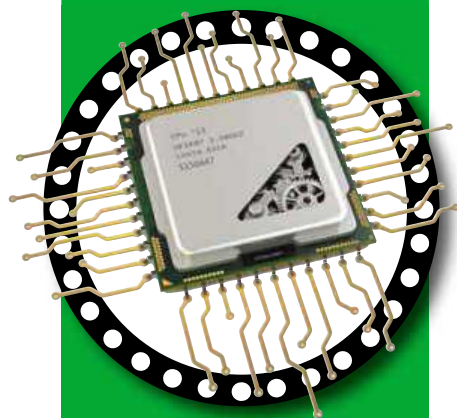
Also notable in the specs was the inclusion of an NFC radio which, along with the fingerprint reader, means Android Pay is possible on the handset (something not possible on its predecessors that lacked NFC). When Android Pay takes off, which it surely will, those devices that don't have the hardware to use it will begin to look a generation behind, so it's good that OnePlus has finally taken the right step and embraced it. Of course, the fingerprint reader does the other prerequisite security roles that a fingerprint reader performs too.

There's also an 8MP front (sorry, but I'm still not saying 'selfie') camera, which is ideal for capturing every moment of self publicity in stunning detail, plus a fast charging circuit that boasts 60% charge in 30 minutes – but yes, you'll need to use the supplied charger and cable.

The OnePlus Three is maybe not quite the pinnacle of mobile phones at present, but it isn't far off, and it has the USP of costing £309 SIM free – some 50% less than most flagships. It's pretty much flagship spec, though, and that 6GB will soon come to life with the right ROM, something OnePlus is traditionally only too happy to accommodate, with an easy to unlock bootloader. That it's not available in shops, only from OnePlus outside of the UK, is a pain, but frankly for the money, there's little that can touch its high quality and specification.



If You're Gonna Go...



Andrew Unsworth moons over the forthcoming iOS update and mourns the passing of an elderly PC

Last week, I wrote about Apple watchOS, the operating system that runs on its smartwatch. I like the idea of a smartwatch, but I'm not convinced enough to spend over £500 on one. This week, I'll be continuing the theme by looking at the highlights of the forthcoming update to iOS.

I make no secret of the fact I'm an iOS fan, preferring it to other mobile operating systems, and it's always good to see what new features and improvements are included in a big update, such as the upcoming iOS 10, which is due for release in the autumn. This time, Apple has promised improvements to iMessages, the Apple Maps app and Siri. New features come in the form of Home, which is an app that lets you control home automation products, and Memories, which presents users with old, forgotten images, presumably to prompt nostalgia in whoever views them.

The Home app is perhaps the most exciting of the new features for a tech fiend. Apple says that the Home app provides a "secure way to set up, manage and control your home", and the focus on security is reassuring. I have a love-hate relationship with home automation tech, in that I love the idea but I'm worried about others' ability to interfere with them.

Apple says that home automation products can be controlled individually or as a

group, and the Home app expands on Apple's HomeKit technology (tinyurl.com/ja6f287) to enable greater control and integration with Home-Kit-enabled gear.

There are many more features than are listed here. To check them out, visit tinyurl.com/gvxq3bc.

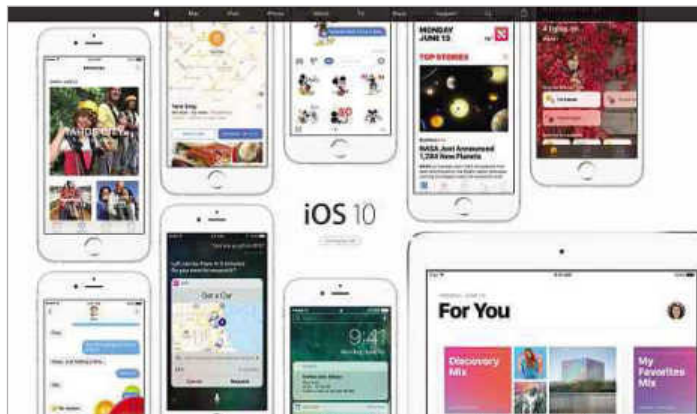
Go With A Bang

A couple of weeks ago, I mentioned that I'd inherited an old computer, a very old computer, a computer so old that it used an 8x AGP graphics card. I wasn't so sure what to do with it and posited the idea of ripping out its innards and replacing them with more modern components. Another idea was to install one of the more compact versions of Linux on it and use it as a development computer for playing about with programming languages and database management systems. This weekend, after successfully installing an SSD in

a laptop, again (yes, I know, I'm obsessed), I thought I'd start it up and install a Linux distro on it to get the ball rolling.

I plugged it in and switched it on, expecting to be greeted by the usual beep. Instead, I was greeted by an almighty pop that was followed by the smell of a thousand cap guns discharging at once. The smell was a nice bit of nostalgia, and I spent a split-second with the fierce heat of the 1990 sun on my neck, the sound of DNA's 'La Serenissima' in my ears, grass under my feet and a cap gun in my hand, shooting wildly at my mates as we all played 'army' over the fields. It was a tender moment, for sure, but the sizzling power supply soon brought me back to 2016, and I hurriedly pulled the plug on it.

I've heard tell of power supplies giving up the ghost in dramatic fashion, but I never thought I'd ever experience it myself. I like its style, though. If you're going to go, go with a bang, not a whimper.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

Hardware



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming

Evil Dead

Capcom packs away the guns and ammo in *Resident Evil VII*, which will emphasise first-person horror over action. Similarities to Konami's *P.T.* are purely coincidental

This week, Ryan takes a look at Capcom's plans for *Resident Evil VII*, and checks out Respawn's mech shooter sequel *Titanfall 2*...

Plug & Play

It's 20 years since *Resident Evil* defined the horror genre and scared the life out of a generation of gamers. Since then, developers from all over the world have brought us their own exercises in interactive terror, from Konami's rival franchise *Silent Hill* to Chinese Room's *Amnesia: A Machine For Pigs*. After the relative disappointment of *Resident Evil 6*, can Capcom bounce back with a truly great horror game?

The first promo for *Resident Evil VII* certainly suggests that Capcom is aiming for a total reinvention and maybe taking a bit of inspiration from the recent crop of horror games that have scared the life out of us in recent years. First, the sequel appears to take place in the grounds of an old, mouldering house once again – and this time, the action's viewed from a first-person viewpoint. For the first time in nearly a decade, the franchise is also taking a step back from the guns-and-ammo, action heavy focus we increasingly saw from *Resident Evil 4* onwards.

"If anyone out there has a bloodlust for holding a gun, check out *Umbrella Corps*,"

the game's director Koushi Nakanishi told Eurogamer at E3. "We are separating these aspects out into different titles where that gameplay can come to the fore, and makes the most sense for that title. [*Resident Evil VII*] is not going to be a gun fest."

It could be that the return to horror rather than gunplay is a response to *Resident Evil 6*, which felt like an uneasy attempt to reconcile the franchise's slow-paced horror roots with crowd-pleasing action set-pieces. What we don't yet know is what the sinister threat in *Resi VII* will be – or even who the protagonist is. Producer Masachika Kawata told IGN that he and his team are keen to maintain an air of mystery around the game, and are therefore keeping specific details under wraps.

Even the game's demo, which emerged for the PlayStation 4 shortly after its E3 announcement, isn't taken directly from *Resi VII*'s campaign. Like *P.T.*, the demo for Konami's ill-fated *Silent Hills*, it's intended to give a flavour of *Resi VII*'s pace and tone rather than a preview of its plot. What we do know, for now, is that at least part of the game will take place in and

around an American farmhouse, and that the herbs from earlier titles will make a return appearance. Kawata has also confirmed that *Resi VII* will take place in the same universe as earlier series entries, so there are likely to be hidden connections and Easter eggs from the previous games dotted around here and there. All we can say is, if there isn't a scene where some dogs come crashing through a window at some point, we'll be mildly disappointed.

Resident Evil VII is scheduled for release on 24th January.

Online

Respawn's guns-and-giant robots opus *Titanfall* may not have redefined the shooter genre as we know it, but it was still a lot of fun. The ability to move nimbly on foot or clamber into a towering, heavily armed mech gave *Titanfall* a pleasing level of variety and drama. With this autumn's *Titanfall 2*, Respawn is hoping to change things up a bit with another new addition: grappling hooks. Yes, it's a mechanic we've seen in everything from *Bionic Commando* to *Just Cause*, but the addition makes sense in a game where robots tower over



▲ Respawn adds grappling hooks to its mech shooter formula in this autumn's *Titanfall 2*. Expect new kinds of mech classes and the debut of a first-person mode

puny humans. With the hook, players will be able to fling themselves up in the air and land gracefully in the driving seat of their mech. Alternatively, they can use the hook to even the odds when fighting an opponent who's strapped into a Titan. We'll be able to winch ourselves up to the top of their mech and disable the clanking thing by ripping out its power cell. The game's multiplayer trailer also reveals that the hook can be used to ensnare an enemy and pull them into range for a close-quarters death blow, which looks rather satisfying.

Respawn is also adding six new classes of Titan, some currently undisclosed new weapons, and a single-player campaign to go alongside the 12-on-12 online mech battles. *Titanfall 2* appears to be shaping up well as an expansion of its predecessor, but the timing of its release could make it something of an underdog. EA's *Battlefield 1* and Activision's *Infinite Warfare* will both launch in the same frame as the *Titanfall* sequel, and both

being heavily marketed on their changes in direction. *Battlefield 1* is heading back to the Great War for a bout of early 20th century combat, while *Infinite Warfare* is blasting off into space with aerial dogfights among the stars. Both games carry a level of risk with them, however; even with the allure of its 64-player battles, is a shooter set in World War I going to enjoy the kind of mass appeal EA is looking for? Will *Call Of Duty's* legion fans appreciate *Infinite Warfare's* unexpected swerve into aerial combat? The negative reaction to the latter's debut trailer on YouTube could suggest Activision has an uphill battle on its hands, but the inclusion of a remastered *Modern Warfare* with copies of *Infinite Warfare* could give the shooter the boost it needs.

If the fan response – and initial reviews – to *Titanfall 2* are positive, however, then Respawn's sci-fi shooter could still win the autumn's battle of the shooters.

Titanfall 2 is due out on 28th October.

Incoming

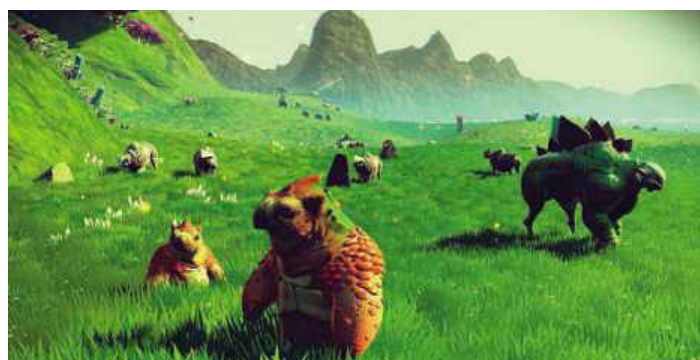
Forthcoming space sim *No Man's Sky* has seen its fair share of drama behind the scenes, with a flood at Hello Games' offices early in development, to death threats from some players when the game's release date was pushed back. But more recently, designer Sean Murray revealed that another complication had emerged, away from public view: TV corporation BSkyB reportedly disliked the use of the word 'sky' in the game's title and promptly engaged in some unspecified legal wranglings.

"Yay!" Murray wrote on Twitter. "We finally settled with Sky (they own the word 'Sky')."

We can call our game *No Man's Sky*. 3 years of secret stupid legal nonsense over."

You might think that trying to prevent a games company from using a common word from the dictionary is a bit strange, but Murray points out that BSkyB really does have form with this kind of thing. "This is the same [company] who made Microsoft change Skydrive to Onedrive," Murray wrote, "so it was pretty serious." Fortunately, the situation was resolved, and the game didn't have to change its name to *No Man's Space* or something like that.

No Man's Sky is out on 9th August. [mm](#)



▲ Hello Games had a private run-in with BSkyB's legal department according to designer Sean Murray. They wanted to take the 'sky' out of *No Man's Sky*, apparently...

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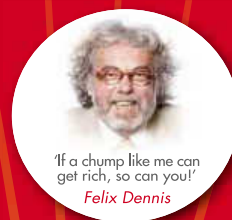
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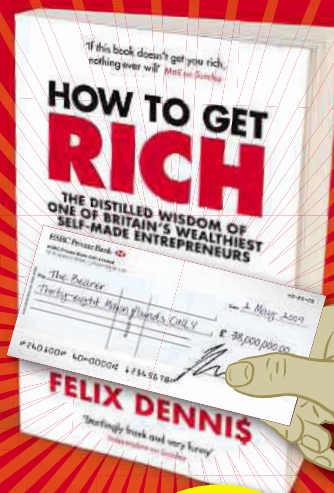
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Wanted: Quicken 2001. I desperately require a copy of QUICKEN 2001, UK Edition. I need to reinstall the program but have lost my original installation CD.
Email: david.maddams@icloud.com

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Meet Aaron Birch. He's here to help you with any general upgrading, software and system building problems. He's got advice aplenty and you're very much welcome to it!

Send your questions to:
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Micro Mart
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London
W1T 4JD

Contact Aaron by email at:
aaron@micromart.co.uk

Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

Time Lapse

I have a slight problem, which has got me puzzled. I have a self-built desktop machine, which was previously using Windows 7. I also have a relatively new Dell laptop, previously using Windows 8.1. The clock on both of my PCs used to keep perfect time. Since upgrading both to Windows 10, my clock seems to go three to four hours out of sync with the correct time after I have switched both off and restart a few days later. Why should this be the case?

Robert

There are a few possible causes for this time keeping problem, including an older issue that may still be relevant in some systems and is worth noting. First, take a look at your system's time zone setting and ensure it's set to the correct zone. If it isn't, every time you reset the time manually, the system may reset it to the time zone it has configured, thus potentially losing you time.

*Second, have a look at your clock settings via the taskbar. Simply click the time display at the bottom-right of the screen and select 'Change Date and Time Settings'. In the next window, click the Internet Time tab and make sure your system clock is set to synchronise with an online service (probably **time.windows.com** by default). If it isn't, click 'Change Settings' and set this up. Even if it is, consider trying a different online clock to sync with.*

Next, it's wise to check the good old CMOS battery. Although this is something we all remember from older systems, and it was a common fault, today it's not as prevalent due to online clocks, but it can still surface. It's the battery that keeps your CMOS clock and settings going when it's turned off, so it's always worth checking.

Lastly and perhaps the most probable cause, is malware. Viruses and other malware have been known to interfere with

computer settings, including simple things like the clock, and this is a common indicator of an infection. Run a full system scan with your anti-virus software, and try a couple of different malware scanners. It's likely you'll find something, so be sure to use the software to remove the infection. This is why you should pay attention

within your systems BIOS could be causing the problem. If so, you can remedy this by disabling it. To do so, you'll need to boot into your system's BIOS to locate and disable APM. Once this is done, return to Windows and go into Control Panel. Go to Power Management, and change the settings relating to APM and let Windows manage it.

**“ Check to make sure
your Windows Update is
functioning correctly ”**

to seemingly simple PC functions; they can be a good early warning.

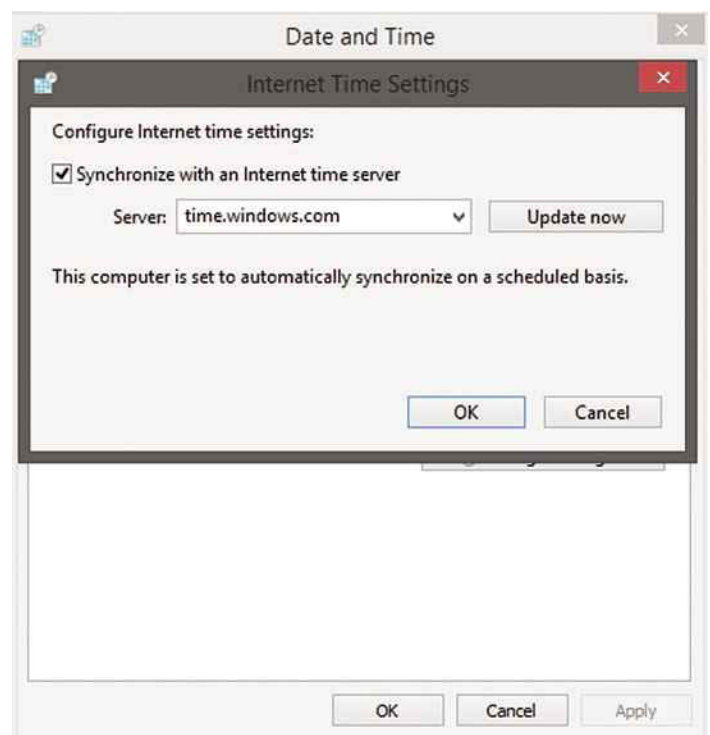
As well as these steps, I'd also check to make sure your Windows Update is functioning correctly. Run an update and ensure your copy of Windows is up to date.

For users with older systems, Microsoft also pointed out a couple of other possible causes for this problem.

The system's APM settings (Advanced Power Management)

Alternatively, there have been instances in the past for third-party security software to cause clock-related problems. Microsoft recommended disabling such software, followed by a clean boot to see if the problem persists. If it's no longer present, try examining the settings of the third-party tools to see what's causing the problem.

▼ **Windows should synchronise its clock with online services, but if not, it could lose time**



Laptop Battery Use

I have a question about laptop batteries, specifically how I should care for them. I've had to replace a couple of batteries in the past, and I've recently purchased a new laptop and want the battery to last as long as possible. I've been told that you shouldn't leave a laptop plugged in when not in use, unless you're actually charging the battery, as it can overcharge it and damage it. I'm not sure if this is true, but would like your opinion on how to best care for the battery and how long it should last.

Ted

There are a lot of stories about laptop batteries that circulate, and although some are correct, some are a little misguided. Let's clear some things up.

Laptop batteries, like many other rechargeable cells, cannot be overcharged, so there's no reason to worry about any physical damage from leaving a laptop plugged in. Why? Because the laptop uses mains power when plugged in and once the battery is charged, it's only topped up when it naturally loses some charge from sitting idle. The laptop will still work even if you remove the battery, because the main power bypasses it. You're not going to overload it.

Leaving a laptop on charge all the time will rarely cause any negative effects, although some have theorised that the increased and constant heat a laptop generates when it's turned on for long periods can affect the full charge of a fitted battery. This is debatable, of course, but just to be safe, some users actually remove the battery when it's not needed and store it elsewhere. Some recommend you leave the battery with around 40-50% of power and store it in a cool place, like a drawer.

As with many batteries, laptop power cells can lose power over time when not in use, so if you plan a trip and will need

it, always ensure you fully charge it up beforehand, because the 50% charge may no longer be present.

When it comes to a battery's charge life, there's no straightforward answer, because the drain on a battery will be greatly affected by the laptop's specification (with more powerful hardware drawing more power), the size of the display and the tasks the system has to perform.

“Laptop batteries, like many other rechargeable cells, can't be overcharged”

A low-power laptop only doing some basic word processing or light internet browsing will put significantly less strain on a battery than a high-end system playing the latest games, so you have to use your own judgement here, and you'll only find out what your actual laptop battery life is after use. In general, for what most would consider standard daily use, a laptop battery will likely last around two to three hours, with stressful tasks shaving a lot of time off that. Simply use your laptop as you normally do and take note of how much power is used over time from a full charge. Do this over a few days, and you should have a good estimate.

▼ **Laptop batteries are not as fragile as many think, but they still need some care**



ASK JASON



Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
Jason D'Allison
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30 Cleveland Street
London
W1T 4JD

Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Clock Watching

I recently built a gaming PC. It has a Core i5-6600K CPU, a Z170-chipset motherboard, and 16GB of DDR4-3000 memory. The motherboard is supposed to support memory speeds up to DDR4-3866, but I've just run CPU-Z and this says mine is only running at DDR4-2133. What's going on?

P Ross, Gmail

The fastest RAM officially supported by mainstream Skylake CPUs is DDR4-2133 (and DDR3L-1600). Running beyond that requires an overclock, and the ceiling for the overclock depends on the quality of not only the motherboard and RAM but also of the CPU's memory controller. Achieving anything better than Intel's advertised maximum is a bonus, not a certainty. Having said that, the Skylake memory controller was engineered to scale to DDR4-4133, though only top-end

CPUs are likely to reach those giddy heights. And it's not guaranteed.

In your scenario, I expect your motherboard is setting the RAM speed to Intel's official maximum, ensuring that the PC will actually boot. To ratchet things up, you'll need to enter the board's UEFI/BIOS and edit the RAM's settings. This may include tweaking numerous voltages. Cast your eyes over this LegitReviews piece for a

primer: goo.gl/A7XjjH. Cheaper boards don't offer many RAM settings, but Z170 boards are aimed at enthusiasts and usually have more settings than you can shake a heatsink at. Interestingly, that article shows that speeds beyond DDR4-2666 are pointless outside of benchmarks.

▼ Is ultra-fast RAM really worth the money (2 x 4GB of Corsair DDR4-4133 will cost you nearly £200)?



Slipped Disk

I've been given an old tower PC to sell for charity. There was no hard drive, so I've bought a 1TB unit second-hand. However, when I try to install Windows Vista (using the licence sticker on the PC's case), I get the following error: 'Windows cannot be installed to this disk. The selected disk is of the GPT partition style.' Using the onscreen disk tool, I've deleted the partition that was there, but the problem persists. Is the disk faulty? Should I return it to the eBay seller?

David, Hampshire

I doubt the disk's faulty, Dave. The level of support for GPT-partitioned disks in Windows varies from version to version. Some versions support them only as data disks and some versions support them as both data disks and boot disks. I've drawn up the list of runners and riders below.

32-bit Windows

Vista: data only
7: data only
8.x: data and boot
10: data and boot

64-bit Windows

XP: data only

Vista: data and boot

7: data and boot

8.1: data and boot

10: data and boot

There's a big caveat to the above, however. Any version of Windows that supports booting from a GPT-partitioned disk only does so if the PC's motherboard has UEFI firmware. Boards with a good old BIOS are a no-no, plain and simple – MBR-partitioned disks have to be used. So in your case, I guess you're trying to install 32-bit Vista or else trying to install 64-bit Vista on a motherboard that isn't UEFI-based.

If it's the former and the motherboard *is* UEFI-based, you could simply get hold of a 64-bit setup DVD. Your product key won't care about the OS's bit-depth. How could you get hold of such a DVD? Well, I'll leave that to your imagination.

If you'd rather stick with 32-bit or you're dealing with a BIOS, all you need to do is run some partitioning software. You see, even though only one partition was showing up (before you deleted it), there's probably a hidden one still there, a GPT partition set up by the disk's previous owner. Vista can't see it and therefore can't delete it.

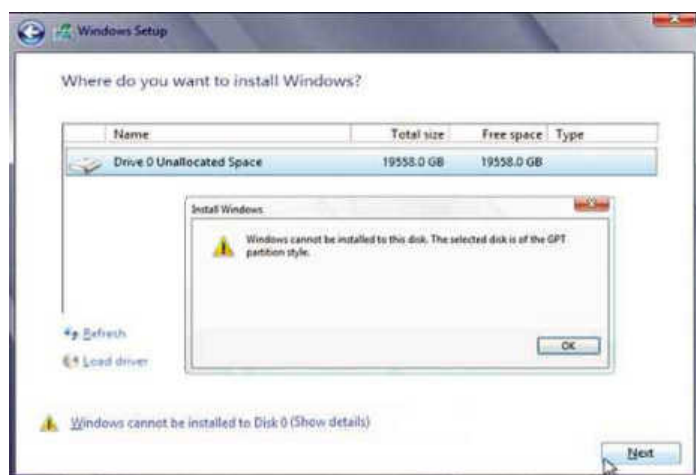
Now, you could connect the disk to another PC, either directly or via a USB enclosure, and run the partitioning software from there, within Windows.

Good bets are the free editions of EaseUS Partition Master (goo.gl/ZcAvrh) and Paragon Partition Manager (goo.gl/92xDBB).

Another option is a Linux-based toolkit, which you could run on the actual problem PC. PartedMagic is where it's at (goo.gl/QLk2xY), but regrettably that now has a price-tag. Older versions are still free, however, and the most recent of those is quite good enough for your purposes (goo.gl/Nq0RT6). Download it, burn it to a CD as an image (not as a regular file), and boot up the PC with it.

Whichever tool you use, Dave, the hidden partition – maybe there's more than one – should now be visible. Get rid. Then partition the disk again – for simplicity's sake, create just one partition to start with, spanning the full 1TB (you can change this later) – and make sure it's an MBR or 'basic' type. Format to NTFS. The whole process should take mere seconds and Vista will then install just fine.

Note – If a given motherboard and OS combination means that GPT partitions are supported, you've pretty much got to use them. Here, the reverse problem usually applies: Windows will refuse to touch an MBR-partitioned disk. Confusing? With PCs, when is it not?



▲ Thanks for letting me know, but what do I do now?

Computer Says 'No'

Here's a related query...

A few months ago I bought a custom-built PC from a local shop. The specs are as follows.

CPU: Core i7-6700K

Motherboard: Asus Z170 Pro Gaming

RAM: 2 × 8GB DDR4-3400

SSD: 500GB Samsung 850 Evo

HDD: 4TB WD Black

GPU: 4GB GeForce 980 GTX

The PC was supplied with Windows 10, which I've been getting on okay with, but some of my games just don't want to play ball (I've got some older ones). In most cases Windows' various compatibility modes haven't made any difference. The upshot is that I want to install Windows 7 – I've got a retail product key from my previous PC. For some reason, though, I can't boot from the setup DVD. I've configured the DVD drive as the first boot device in the motherboard settings, but the PC just boots from the SSD regardless. Any ideas?

Michael O'Neill, Outlook.com

Most new motherboards use UEFI firmware instead of a BIOS. That's true of the Z170 Pro Gaming. For the most part, this is good, as it opens up more options and flexibility to the end user. And those blocky old BIOS pages just look so ... retro. UEFI firmware, in combination with Windows 8.x or 10, allows for a feature called Secure Boot, which Microsoft introduced to make PCs less vulnerable to rogue software (Linux fans might also say it was introduced to make Linux less accessible).

With Secure Boot enabled, a PC will only boot from a source that contains a security key the UEFI recognises. All other sources will be ignored – just as you've found, Mike. Although PCs sold with Windows 8.x or 10 pre-installed are supposed to ship with Secure Boot enabled (small-scale sellers often flout this rule), almost all consumer motherboards allow it to be disabled.

What you need to do, therefore, is enter your Asus's UEFI and navigate to the relevant settings. You'll find them under the Boot menu. To reveal that, you'll first have to switch from EZ Mode to Advanced Mode – you should see a link at the bottom-right of the main screen. Once you're in, go to the Secure Boot submenu and select Other OS as the OS Type. The present selection is probably 'Windows UEFI mode'.

If the PC still won't boot from your Windows 7 setup DVD, revisit the Boot menu and this time enter the 'CSM (Compatibility Support Module)' submenu. Under Launch CSM, choose Enabled. Currently it's probably set to Disabled or maybe Auto. And if you're *still* not off and running, go back to the same submenu, select Boot Device Control, and choose 'Legacy OPROM only' or maybe 'UEFI and Legacy OPROM'. Perhaps at the moment you've got 'UEFI only'. One way or the other, Mike, trial-and-error with these or other likely settings will sort you out.

▼ The sheer quantity of options in some UEFIs can be overwhelming



Crowdfunding Corner

If you like unconventional mobile projects, we have a great pair for you in this week's column: a low-cost hybrid tablet/laptop and a solar panel for your phone!

Azpen Hybrx Android Laptop

Hybrid laptops are historically not great, but the Hybrx might be the one that changes all that. This Android-based device is powered by Remix OS 2.0 and an Allwinner Cortex A53 quad-core processor running Android Lollipop (5.1). The ultra-slim laptop has an 11.6" 1366 x 768 HD screen and comes in two configurations: 1GB RAM and 16GB flash or 2GB RAM and 32GB flash.

Although it runs Android, the OS is a fully multitasking environment with mouse support, a file manager and full keyboard input. It even has Office available for it. You can expand the memory by up to 32GB using a micro-SD card, and plug in two USB devices for connecting printers, microphones, speakers and other external devices. There's also a mini-HDMI port for an external display, and a standard headphone jack.

The price is incredibly low too: back it quickly enough and you can pick up a basic (16GB) Hybrx for just \$69, which is less than £50. The 32GB version is available throughout the campaign for \$89 (£60). Higher tiers offer extra perks, but none that are as good value as the laptop itself. The hardware is due to ship in September 2016 provided it meets its \$75,000 target – and with over a month to go and \$20,000 already achieved, it seems very likely it will!

URL: kck.st/28Nj134

Funding Ends: Thursday, 4th August 2016

Solarpad USB Charger

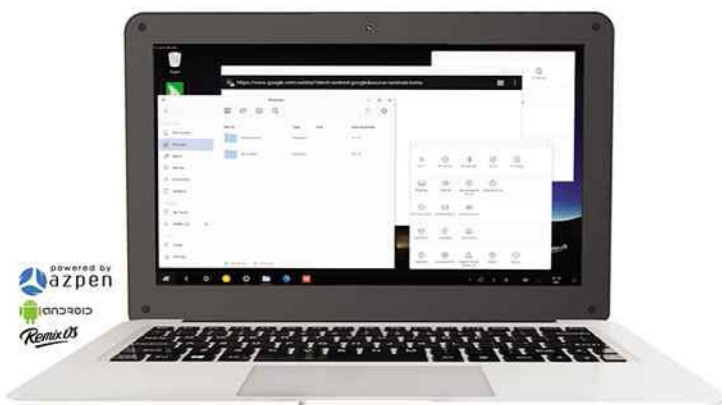
Getting solar power to charge your devices is one of the holy grails of renewable energy, and we've seen a few solar power kickstarter projects over the years. This, however, is one of the better-priced examples, with units starting at \$69 (£46).

The solarpad kit contains a high-quality solar panel, laminated for high-efficiency and lightweight carry. A 3350mAh USB battery included in the kit can be used as a power bank for later, or you can plug the solar panel directly into your device for instant charge. It doesn't waste a scrap of power; it even comes with special thick-gauge USB cables for more efficient electricity flow (though you can use your own cables too!).

In full sunlight (or with a full battery), it can recharge a typical iPhone to 100% in three to four hours. It's small and weighs just 143g in its holder. For \$69 (£46) you can get the solar panel or the battery pack or pay \$109 (£75) to get both. Or if you fancy going it alone, you can pay \$29 (£20) to get just the solar panel for use in your own projects, so if you know how to solder a USB port, you'll be able to save tons of money! The campaign runs for two months and is looking for \$28,000, which seems achievable to us. Devices ship in June 2017.

URL: kck.st/28QJkt2

Funding Ends: Friday, 19th August 2016



Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

PlayDOSGamesOnline

We're pitting our skills against old school gaming again

I had an urge the other day to see if I could get through *Alone in the Dark* without resorting to any kind of cheats or walkthroughs. As it happens, the most difficult part of the process was actually finding a working copy of *Alone in the Dark* to play.

My virtual DOS setup hasn't been behaving in recent months, for some reason or another, so when I came to load up *AitD*, it kept crashing out at the intro. After trying repeatedly to copy the image of the game from the virtual machine to somewhere I could open it in DOSBox, I finally gave up and settled for something a little more modern.

However, what I should have done is to open up PlayDOSGamesOnline and play it via my browser.

C:\

As the name suggests, this is a site that's dedicated to bringing you thousands of abandonware DOS games through the browser and using DOSBox.

While there are lots of other sites, including the Internet Archive, PlayDOSGamesOnline seems to get the

right mix of settings needed to be able to play the game properly – at least on the few dozen we've been playing over the weekend.

As you would expect, getting to a game and running it is easy. All you need to do is find the game you want, either from the genre links along the top of the main page of the site or with the search box. When you've found your favourite DOS game, click on the link and either click in the DOSBox screen or press the spacebar to begin.

You'll find most games have instructions below the play area, along with any special requirements, keys needed and even some handy hints and tips or a complete walkthrough. The hardest part is finding which of the many games you'd want to play.

While it's always fun to have an emulated system, in the form of a virtual machine or a locally installed DOSBox or even a real 486 DX2-66 with DOS 6.22 and Windows 3.11 installed, there's an extra level of convenience to PlayDOSGamesOnline and other sites like it. Granted, it's not the same, and there's

Features At A Glance

- Free online DOS games.
- Over 3,500 titles available.
- *Prince of Persia*, *Wolfenstein*, *Commander Keen*, *Warcraft 2*...
- Kept up to date, active community.

always a chance that the sound will drop out or fail completely, but for a quick ten minutes or to relive the anxious moments of hunting down an alien in *UFO: Enemy Unknown*, PlayDOSGamesOnline works a treat.

Moreover, you can get to sample those games you missed out on the first time around or locate that elusive title that you once played the demo of, as found on a magazine cover.

Big Games

One thing worth mentioning is that some of bigger games, such as *Myst*, require a decent internet connection to enjoy properly. *Myst* itself has a big 470MB file to download and run, among a few other files, and it runs from within Windows 3.11 too, so you'll need to have a semi-good PC.

Another issue is the bottleneck that is the browser. While Chrome does a good enough job, you'll need to make sure you're running the 64-bit version, because it solves a lot of memory problems with DOSBox. Firefox seems to be better. Then again, Firefox does end up taking over 1.2GB of memory when running *Myst*, so be prepared for a possible problem with other programs.

Enjoy

The biggest draw to PlayDOSGamesOnline is the fact that no matter how poor the old games appear next to the newer ones, they're great fun and part of our history. [mm](#)

Myst



▲ *Myst*: one of the most impressive adventure games ever developed

UFO: Enemy Unknown (X-COM: UFO Defense)



▲ *UFO* and countless other games are available online

Logging Off

A week on, I'm still trying to process Microsoft's seemingly bizarre decision to flush \$26bn away to own LinkedIn, because Microsoft doesn't exactly have a wonderful track record of buying external companies. Just ask anyone who worked for Nokia.

The very week this news broke, I also noticed that all the previous employees of another company, Perceptive Pixel Inc.,

simultaneously left Microsoft and set up a new company, Perceptive IO. This operation was founded by Jeff Han in 2006 and went on to be bought in 2012 for an undisclosed amount. It specialised in large-format touch displays as abysmally demonstrated by a number of TV news broadcasters. Microsoft used its know-how to make the Surface Hub, another rip-roaring success in must-have hardware.

But back to LinkedIn, the place that people generally head when they're looking either for a job or to rub elbows with people they think are career influential. It has around 100 million unique visitors a month, which hints at a smaller core of people who actually use it to 'network' with those who see value in that activity.

Working the numbers, Microsoft just paid \$260 for every active user, as if it just sent them all a free mid-range smartphone – if it made any that people might want to own, of course.

Since the acquisition was announced, I've seen numerous business pundits argue all sorts of utter tosh about how Microsoft owning LinkedIn somehow makes it able 'to recreate the connective tissue for enterprises.' Eh?

Putting aside people who spout such moronic garbage, the phenomenal cash cost and Microsoft's very poor record with companies it merged or bought, I believe there is a much bigger problem here. And that is how businesses view LinkedIn, which isn't exactly positive to their thinking. What big firms desire is for their staff to stay in a job for which they're paid less than they're worth, not to take their knowledge and expertise elsewhere, and certainly not to form social media relationships with staff who might work for competitors.

Therefore they're hardly likely to encourage their staff to use LinkedIn, even if they can't stop people using it in their spare time.

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Of course, there is a hypocrisy to all this, because the very same businesses use LinkedIn to cyber-stalk interviewees, poach key people from other companies and generally scope what the market is like for likely post-firing replacements. They'd really like people in other companies to use LinkedIn, making them easier to find, and not the ones in their own, perversely.

There is also the issue about how all this data that it's going to get is used, because Microsoft has 'big data' on the brain these days. What will kill this golden goose pretty rapidly is if the users think Microsoft is flogging their data uncontrollably. I take that as a racing certainty, because I foresee that in an attempt to bolster numbers, everyone with a Microsoft account will magically appear on LinkedIn shortly, with suitable encouragement to fill out all those pesky fields with data.

Over the years, I've come to view Microsoft as an overly raucous child who is occasionally given fragile pets to play, with predictably dire consequences. LinkedIn, it seems, is heading to the corner of the garden where such experiments are buried.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Gay-Lussacs Law, 8 Lean-To, 9 McAfee, 10 Psychic, 12 Aegis, 14 Servo, 16 Provoke, 19 Sturdy, 20 Yo-Ho-Ho, 22 Eavesdropping.

Down: 1 Gale, 2 Clinic, 3 Estonia, 4 Gamma, 5 A Spade, 6 Base Link, 11 Spectral, 13 Grey Goo, 15 Vertex, 17 V-Chips, 18 Dyads, 21 Hand.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. The Euro 2016 football tournament is still going on as we write this, but more importantly, the EU referendum is set to be decided this week. Yes, by the time you read this, we'll know whether we're staying in the EU or not. We're going to remain impartial here, but will say there

was probably an easier and less expensive way to get this sorted than to organise a public vote. Our solution? A football match. The Euro tournament was on anyway, so why not tack an extra game on the end to decide whether we're leaving the EU? Then whoever is on top after 90 minutes gets to decide the future of the nation. Simple, quick and, more importantly, more fun than a load of televised debates and newspaper articles. Who'd play for each team, though, you might ask. Well, we'd say Boris Johnson and David Cameron might be obvious choices for team captains. But in the interest of fairness and democracy, the best way to choose the teams would be through a vote of some sort. Maybe a referendum?

THIS WEEK'S CROSSWORD

Across

7 He famously won a chess match against the IBM computer Deep Blue in 1996 but in 1997 was beaten by Deeper Blue. (5,8)

8 Something done, made or happening only once. (3-3)

9 A type of computer printing that recreates a digital image by propelling droplets of ink onto paper. (6)

10 Play or arrange tracks on a music player in a random order. (7)

12 Popular name for the British Phonographic Industry's annual pop music awards. (5)

14 An open source project dedicated to creating a Unicode framework for rendering international text. (5)

16 The X-shaped structure formed at the point below the brain where the two optic nerves cross over each other. (7)

19 That's exactly right! (4,2)

20 Bristling with perplexities? (6)

22 The purchasing of goods without planning to do so in advance, as a result of a sudden whim. (7,6)

Down

1 The amount of increase in signal power, voltage or current expressed as the ratio of output to input. (4)

2 Go back on a promise or fail to keep to an arrangement. (3,3)

3 A kind of folk music with a blues or jazz flavour that was popular in the 1950s, played by a small group and often incorporating improvised instruments such as washboards. (7)

4 An early form of sonar used to detect submarines. (Acronym) (5)

5 A programmer who breaks into computer systems in order to steal, change or destroy information as a form of cyber-terrorism. (6)

6 The product of a body's mass and its velocity. (8)

11 A device that transfers heat from a colder area to a hotter area by using mechanical energy. (4,4)

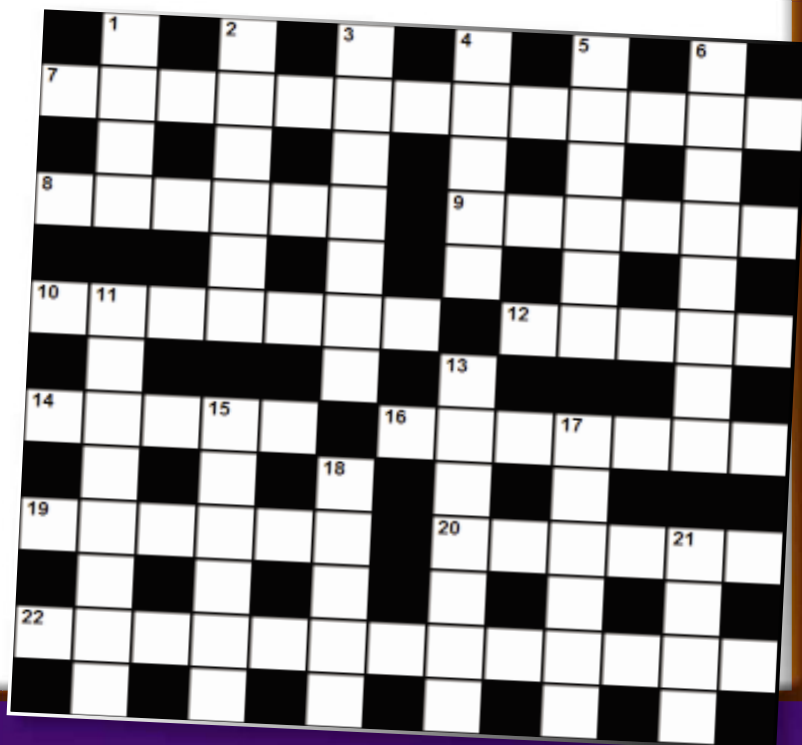
13 Underground railway system in London. (3,4)

15 A web-based revision control hosting service for software development and code sharing. (6)

17 A fictitious name used when the person performs a particular social role. (6)

18 A feeling of deep anxiety about the human condition or the state of the world in general. (5)

21 A prefix meaning extremely small. When quantifiable, it translates to one-billionth. (4)



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